FY 1992 **FINAL PRODUCT** Task 63
Strmwtr Drainage Mgt. Plan

A COMPREHENSIVE DRAINAGE STUDY AND STORMWATER MANAGEMENT PROGRAM

FOR

THE TOWN OF WEST POINT, VIRGINIA

PREPARED BY

LANGLEY AND McDONALD, P.C.
WILLIAMSBURG AND VIRGINIA BEACH, VIRGINIA

November, 1993

Langley and McDonald, P.C.

Engineers
Surveyors
Planners
Landscape Architects
Environmental Consultants

5544 Greenwich Road, Virginia Beach, VA 23462
(804) 473-2000 FAX: (804) 497-7933

201 Packets Court, Williamsburg, VA 23185
(804) 253-2975 FAX: (804) 229-0049

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1.0 EXECUTIVE SUMMARY

This report documents the findings and recommendations of the comprehensive drainage study and stormwater management program for the Town of West Point. This project was divided into two phases: the development of the drainage inventory (Phase I) and the drainage study and recommendations for stormwater management (Phase II). A Stormwater Advisory Committee consisting of representatives from the Town, the State, and Langley and McDonald was formed to provide input at various stages during the study.

The development of the drainage inventory included smoke testing and camera inspection of selected pipes, field surveys of the drainage system, the delineation of watershed boundaries, and aerial photographs of the Town. Deliverables to the Town include: videotapes and individual data sheets of the camera inspection, field survey notes, reproducible topographic maps with the drainage system drafted onto them, digital files of the watersheds, and color and infrared aerial photographs.

The drainage study documents existing conditions within the Town with respect to the quantity and quality of runoff, and estimates potential impacts that future development may have on the Town's drainage system and receiving waters. Hydrologic and hydraulic modeling were performed on the four major stream systems within the Town. Pollutant loadings generated from existing and future development within the Town were estimated based on procedures established by the Chesapeake Bay Local Assistance Department.

Hydrologic modeling of West Point Creek and three tributaries to the Mattaponi River were performed using HEC-1. Runoff hydrographs for the 2-, 10-, 25-, and 100-year storms were calculated for these watersheds under existing and future development conditions. The modeling results indicate that many of the drainage systems within the Town are inadequate. Trouble spot areas are noted in the report.

The Town is divided into two watersheds for the purpose of documenting the results of the water quality calculations. The area draining to the Pamunkey River has an average existing phosphorus export of 1.06 pounds/acre/year corresponding to an impervious cover percentage of 45. The area draining to the Mattaponi River has an average existing phosphorus export of 0.82 pounds/acre/year corresponding to an equivalent impervious cover percentage of 34. These average land cover conditions set the threshold by which future development may have to provide for water quality controls under the Chesapeake Bay Preservation regulations.

Based on the results of the drainage study, recommendations for stormwater capital improvements, ordinances and policies, maintenance, and financing are provided. Specific recommendations in these four areas are found in Sections 5.0, 6.0, 7.0, and 8.0.

Capital improvement recommendations include the upgrade of culverts and storm sewer systems to meet VDOT-specified design criteria, and the acquisition of drainage easements to facilitate adequate drainage and maintenance. Land use management practices should be implemented to achieve a "no net increase" in phosphorus loadings to the receiving waters.

Recommendations for revisions and additions to the local Chesapeake Bay Preservation regulations, the Subdivision ordinance, and general policies are provided. These recommendations address the existing land cover conditions as determined for West Point for the Chesapeake Bay Preservation Act, and the performance of drainage systems within the Town.

In the Town of West Point, the Virginia Department of Transportation is responsible for maintaining the drainage systems within the right of way. Unless the Town receives adequate funding from the State, VDOT should remain responsible for these systems. The Town should implement a regular maintenance program for those portions of the system outside the right of way, including the acquisition of drainage easements where the drainage system is located on private property.

Options that the Town could consider to fund stormwater management include general obligation bonds, revenue bonds, land development fees, participation agreements, special service districts, and a stormwater utility. Each of this options is discussed is Section 8.0. A comprehensive approach consisting of traditional methods augmented by the creation of a stormwater utility and periodic issuance of revenue bonds should provide a stable, long-term source of revenue to implement the stormwater management program.

2.0 BACKGROUND AND SCOPE

In the Fall of 1992, the Town of West Point requested proposals from engineering firms for the development of a comprehensive drainage study and stormwater management program. As stated in the Request for Proposals, the purpose of the project "is to develop a comprehensive water management program to control flooding and property damage, soil loss, and point and nonpoint source pollution in the water stream in and around West Point". To accomplish the tasks requested by the Town, this project was divided into two phases. Phase I involves the development of the drainage inventory, and Phase II includes the drainage study and recommendations for stormwater management.

Our project approach included the formation of a Stormwater Advisory Committee designed to provide input at various stages of the project to ensure that Town goals were being met. This committee included the following individuals:

Watson Allen	Town Manager, Town of West Point
C.J. Sanders	Councilmember, Town of West Point
James Vadas	Planning Commission, Town of West Point
Herb Brown	School Administration, Town of West Point
Mary Causey	Wetlands Board, Town of West Point
Joshua Lawson	Chamber of Commerce, Town of West Point
John Nein	Chesapeake Corporation
Olen Sikes	Chesapeake Corporation
Brian Wagner	Chesapeake Bay Local Assistance Department
Keith White	Chesapeake Bay Local Assistance Department
Joseph Battiata	Virginia Department of Conservation & Recreation
Julie Brown	Virginia Department of Transportation
Norman Mason	Langley and McDonald
Diana Tulis	Langley and McDonald
Steve Romeo	Langley and McDonald
Jack Whitney	Langley and McDonald

Periodic meetings were held to inform the committee of project status, and to develop agreed upon objectives of successive tasks.

With the aid of a consultant, the Town is currently developing a Geographical Information System (GIS). Digital information created by this project (i.e. drawing, spreadsheet, and word processing files) can be utilized by a GIS. Langley and McDonald has coordinated with the GIS consultant to determine file format compatibility. Data Transfer Files (DXF) files will be used to transfer the graphic information and Worksheet Files (WK1) will be used to transfer spreadsheet data.

This report is divided into eight sections as follows:

1. Executive Summary:	Provides a managerial overview of the project.
2. Background and Scope:	Describes the objectives of the work.
3. Drainage Inventory:	Discusses Phase I of the project.
4. Drainage Study:	Discusses Phase II of the project.
5. CIP Recommendations:	Sets forth recommendations for capital improvement projects based on the Drainage Study.
6. Ordinance/Policy Recommendations:	Sets forth recommendations for new/revised stormwater management regulations.
7. Maintenance Program:	Provides recommendations for maintenance of stormwater system.
8. Financing:	Describes available funding options for implementing stormwater management program.

3.0 DRAINAGE INVENTORY

The first task undertaken in this project was to determine the physical components of the drainage system within the Town. This task included smoke testing and camera inspection of selected storm pipes, field surveys of the drainage system, and the delineation of watershed boundaries based on existing mapping and field verification of these boundaries. Also included in this phase of the project was the production of color and infrared aerial photographs of the Town from photography dated April 12, 1993.

3.1 SMOKE TESTING AND CAMERA INSPECTION

To determine drainage system components and possible cross-connections, smoke testing was performed on 14,305 linear feet of pipe. By forcing smoke through pipe sections, determinations were made as to connecting structures, pipes, outfalls, pipe failures, and possible cross-connections of the sanitary sewer system. Smoke testing revealed scattered pipe failures and one possible cross-connection on Lee Street between 7th and 8th Streets.

Once the system connections were determined, select pipes were cleaned and inspected by video camera to determine their condition. Camera inspection was also used to help determine the location of drainage systems where smoke testing was unable to do so. A total of 6,464.4 linear feet of the Town's drainage system from 14th Street south and selected sections north of 14th Street were videotaped. The resulting videotapes and individual data sheets from this inspection have already been provided to the Town.

Listed below are some of the observations resulting from the camera inspection.

- Initial attempts of the camera to "crawl" through some of the pipes were unsuccessful due to sediment and debris in the pipes. Efforts were made by the Town to clean the pipes by pressure washing; however, sediment and debris remained in certain sections of the system which impeded the path of the camera.

- Many of the pipes experience root penetration at the pipe joints, some of which severely block the flow of water through the pipe.

- Several sections of pipe within the Town have offset joints and cracks, some of which experience infiltration.

- Several sections of pipe have other utilities running through them which reduces the capacity of the storm pipe.

- Buried manholes were found.

- Attempts were made to inspect tidal-influenced pipes during low tide. Water was still present during low tide in some of these systems.

- Pipe sag was encountered in several locations.

- No cross-connection was found on Lee Street between 7th and 8th Streets. Camera inspection of the sanitary system revealed a broken storm drainage pipe above a broken sanitary pipe. These pipes have since been repaired by the Town.

3.2 FIELD SURVEYS

The Town's storm sewer systems were surveyed to determine pipe size, material, length, rim and invert elevations. Culverts at road crossings were also surveyed. These systems were drafted onto reproducible Town topographic maps at a scale of 1'=100'. A storm drainage inventory was developed for each topographic map. This inventory was developed in a spreadsheet format that is compatible for use with the Town's future GIS. The maps and inventory have been provided to the Town under separate correspondence.

Field investigations were also made to determine typical cross-sections of certain channels and ditches, and to estimate their corresponding roughness values. This information is contained in Appendix 1.

3.3 WATERSHED BOUNDARIES

Watershed boundaries were delineated based on existing topographic mapping. Where appropriate, boundaries were adjusted to reflect conditions in the field. These boundaries are provided in digital format to be compatible with the Town's GIS.

3.4 AERIAL PHOTOGRAPHS

An aerial photograph of the Town was taken on April 12, 1993. Color and infrared copies of the photograph have been provided to the Town. These photographs were used to delineate existing land uses for water quantity and quality modeling.

4.0 DRAINAGE STUDY

As the Town of West Point grows, additional development will impact the quantity and quality of stormwater runoff. The goal of this study is to document existing conditions within the Town with respect to stormwater runoff quantity and quality, estimate the impacts that development may have on the Town's drainage system and receiving waters, and recommend measures to control adverse impacts that might occur as a result of development.

4.1 TECHNICAL APPROACH

HYDROLOGIC MODEL

The U.S. Army Corps of Engineers' "Flood Hydrograph Package" (HEC-1) computer program (version 4.0.1E, revised May, 1991) was used as the flood hydrograph and routing model.

Basic hydrologic inputs were developed in accordance with the USDA, SCS publication "Technical Release No. 55, Urban Hydrology for Small Watersheds", 2nd edition, June, 1986. Adjustments to times of concentration were made using methodologies described in A Guide to Hydrologic Analysis Using SCS Methods, Richard H. McCuen, 1982.

No published soil survey exists for the Town of West Point. Soils data was taken from maps of the area located at the Three Rivers Soil and Water Conservation District.

Topographic information was provided by the Town on 1"=100' scale maps at 2' contour intervals compiled by the Sirine Group from photography dated 10/26/85.

Future land use was taken from a map of the Comprehensive Land Use Plan dated September 1986. Table 1 provides runoff curve numbers as a function of future land use and soil type.

Existing land use was taken from the aerial photograph dated April 12, 1993.

Field visits were performed in the Spring and Summer of 1993.

Rainfall data for West Point was developed using information contained in "Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years", Technical Paper No. 40, Weather Bureau, U.S. Department of Commerce, Washington, D.C., 1961, and "Five to 60 Minute Precipitation Frequency for the Eastern and Central United States", NWS HYDRO-35, National Weather Service, NOAA, U.S. Department of Commerce, Silver Springs, Md., June 1977. Depth/Duration/Frequency values used in this study are shown in Table 2.

Table 1 SCS Curve Numbers by Land Use and Soils				
	Hydrologic Soil Group			
Comp. Plan Land Use	A	B	C	D
LDR	50	67	79	84
MDR	54	70	80	85
HDR	60	74	81	87
GC	86	90	93	94
LI	77	85	90	92
HI	89	92	94	95
C	39	61	74	80
PS	66	78	85	88
SD	74	83	88	91

LDR	LOW DENSITY RESIDENTIAL
MDR	MEDIUM DENSITY RESIDENTIAL
HDR	HIGH DENSITY RESIDENTIAL
GC	GENERAL COMMERCIAL
LI	LIGHT INDUSTRY
HI	HEAVY INDUSTRY
C	CONSERVATION
PS	PUBLIC SEMIPUBLIC
SD	SPECIAL DEVELOPMENT

Reference: SCS TR-55

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)} \qquad S = \frac{1000}{CN} - 10$$

Q = Runoff (inches)
P = Rainfall (inches)
S = Potential maximum retention after runoff begins (inches)
CN = SCS Curve Number

Table 2 Rainfall Depth-Duration-Frequency West Point, Virginia						
Duration	2-YR [inches]	5-YR [inches]	10-YR [inches]	25-YR [inches]	50-YR [inches]	100-YR [inches]
5 min.	0.47	0.54	0.60	0.68	0.74	0.81
10 min.	0.75	0.90	1.00	1.16	1.28	1.40
15 min.	0.95	1.14	1.28	1.49	1.65	1.81
30 min.	1.27	1.56	1.77	2.07	2.31	2.54
60 min.	1.60	2.00	2.28	2.68	2.99	3.30
2 hr.	1.81	2.28	2.61	3.08	3.45	3.82
3 hr.	2.02	2.56	2.95	3.49	3.91	4.33
6 hr.	2.55	3.29	3.80	4.53	5.09	5.65
12 hr.	3.03	3.94	4.56	5.45	6.14	6.83
24 hr.	3.50	4.58	5.33	6.38	7.19	8.00

Sources: USWB TP-40
NWS HYDRO-35

HYDRAULIC MODEL

The analysis of culverts was performed in accordance with the Federal Highway Administration (FHWA) culvert design and analysis techniques set forth in the publication "Hydraulic Design of Highway Culverts," Hydraulic Design Series No. 5, FHWA, 1985.

Hydraulic data were developed from field reconnaissance and surveys. Information relative to determining Manning's "n" value was developed from field observations. Manning's "n" values for natural channels were estimated in accordance with SCS procedures set forth in Open Channel Hydraulics by Richard H. French, 1985. Typical channel cross-sections and significant hydraulic structure data were measured in the field.

WATER QUALITY MODEL

A spreadsheet model was developed to calculate pollutant loadings at various locations throughout the Town. The calculations are based upon existing and future land uses as prescribed by the Chesapeake Bay Local Assistance Department in their November 1989 Local Assistance Manual.

Existing land use was based upon the aerial photograph taken April 12, 1993 as part of this project. Future land use was based upon the Town's 1986 Comprehensive Land Use Plan.

PROBLEM SPOT ANALYSES

The rational method (Q=ciA) was used to calculate peak runoff flow rates for existing and future development conditions. Hydraulic grade lines were estimated to evaluate system capacities.

4.2 HYDROLOGIC/HYDRAULIC MODELING

The Town of West Point is a 6.3 square mile incorporated municipality located in King William County at the confluence of the Pamunkey, Mattaponi, and York Rivers. Of the total 6.3 square miles, approximately 4.7 square miles is land area. Twenty-two and seventy-seven percent of the land area drains to the Pamunkey and Mattaponi Rivers respectively. Twelve acres of land located at the southeastern edge of Town drain directly into the York River.

Hydrologic modeling using HEC-1 was performed on the four major stream systems within the Town. These four streams include West Point Creek and three tributaries to the Mattaponi River. Each of the four watersheds is discussed separately below. Detailed printouts of the HEC-1 models are provided in Appendix 2.

As stated in the Flood Insurance Study for the Town of West Point (FEMA, June 18, 1990), the stillwater elevations for the York, Pamunkey, and Mattaponi Rivers and their adjoining tributaries within West Point have been determined for the 10-, 50-, 100-, and 500-year floods. The stillwater elevations for the three rivers and estuaries are 6.0 feet for the 10-year storm, 7.4 feet for the 50-year storm, 8.0 feet for the 100-year storm, and 9.4 feet for the 500-year storm.

Flood elevations along major stream reaches within the Town are controlled by the corresponding flood elevations of these three rivers. The Flood Insurance Rate Maps for the Town show the flood hazard areas inundated by the 100-year flood.

West Point Creek - Existing Conditions

West Point Creek flows from north to south through the middle of Town and empties into the Mattaponi River just south of 12th Street. The West Point Creek watershed is approximately 1.75 square miles in size, with various residential, commercial, agricultural, public, and undeveloped land uses.

The West Point Creek watershed was divided into 26 sub-basins for hydrologic analysis. Figure 1 shows sub-basin delineations. Hydrologic parameters developed for each sub-basin are shown in Table 3.

Figure 2 shows the hydrologic soil groups present in this watershed. As seen from Figure 2, all four soil groups are represented.

The West Point Creek watershed was analyzed under current conditions in the 2-, 10-, 25-, and 100-year events. Table 4 shows calculated peak flow rates for each sub-basin.

Table 5 describes selected system elements and provides estimated peak flow capacities and road crest elevations.

West Point Creek - Future Conditions

To estimate the impacts of future development, hydrologic parameters were developed for the sub-basin assuming full development of the watershed based on the Town's 1986 Comprehensive Land Use Plan. This assumption implies that areas that are currently undeveloped will ultimately be developed to allowable densities, and that areas where densities are lower than allowable will be further densified by future development.

Figure 3 represents future land use patterns for the West Point Creek watershed. If land use patterns change significantly, the results of this study must be reevaluated.

Future hydrologic parameters used as a basis for modeling are shown in Table 6. Table 7 shows the results of the 2-, 10-, 25-, and 100-year storm analyses.

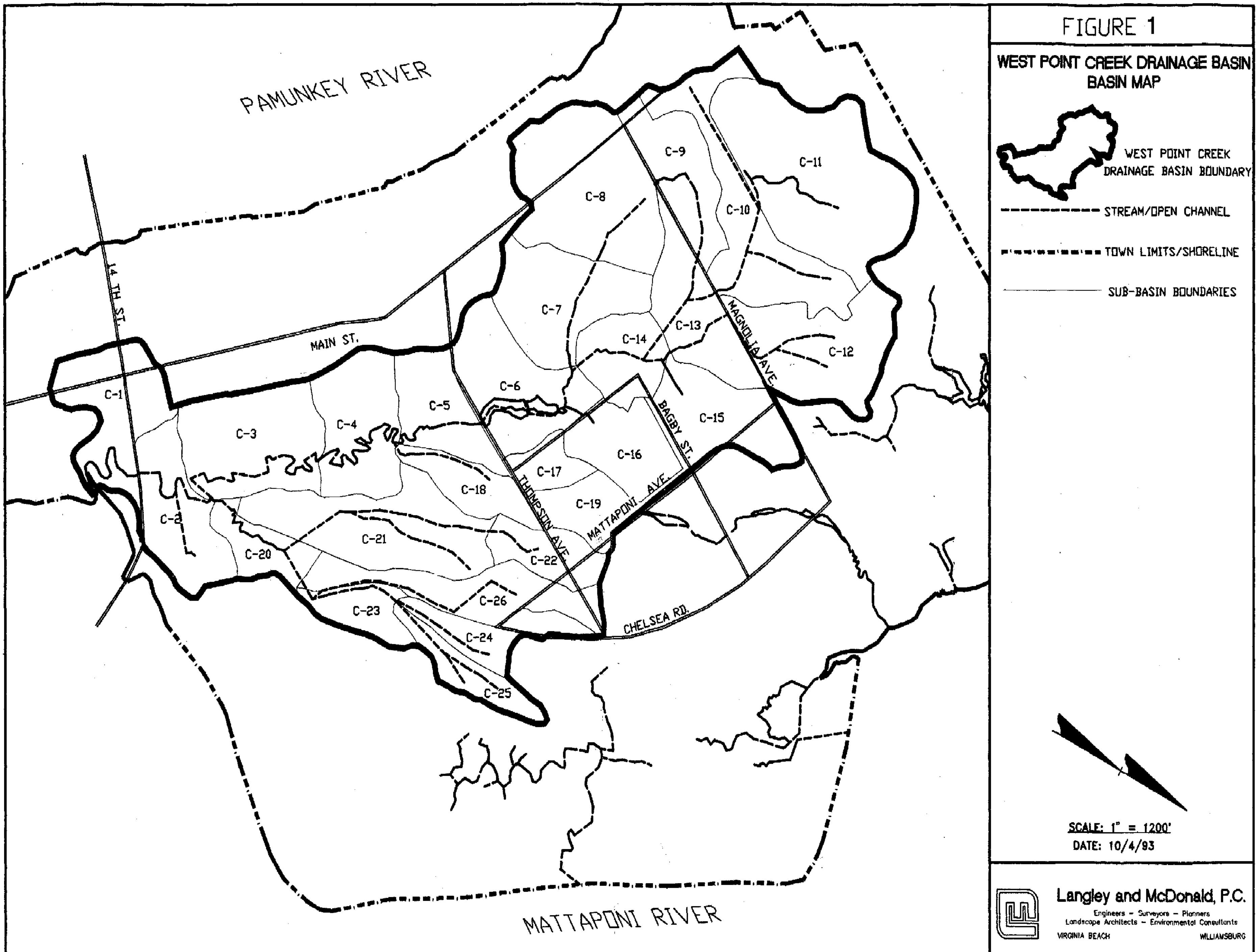


FIGURE 1
WEST POINT CREEK DRAINAGE BASIN
BASIN MAP
WEST POINT CREEK DRAINAGE BASIN BOUNDARY
STREAM/OPEN CHANNEL
TOWN LIMITS/SHORELINE
SUB-BASIN BOUNDARIES
SCALE: 1" = 1200'
DATE: 10/4/93
Langley and McDonald, P.C.
Engineers - Surveyors - Planners
Landscape Architects - Environmental Consultants
VIRGINIA BEACH
WILLIAMSBURG
PAMUNKEY RIVER
MATTAPONI RIVER
14 TH ST.
MAIN ST.
THOMPSON AVE.
MATTAPONI AVE.
BAGBY ST.
MAGNOLIA AVE.
CHELSEA RD.
C-1
C-2
C-3
C-4
C-5
C-6
C-7
C-8
C-9
C-10
C-11
C-12
C-13
C-14
C-15
C-16
C-17
C-18
C-19
C-20
C-21
C-22
C-23
C-24
C-25
C-26

Table 3 West Point Creek Watershed Existing Condition Hydrologic Parameters			
Sub-basin	Area [acres]	Curve Number	Time of Conc. [hours]
C1	50	83	0.65
C2	43	75	0.90
C3	61	71	2.64
C4	47	66	1.55
C5	33	68	1.28
C6	53	68	1.88
C7	54	73	2.10
C8	84	75	1.52
C9	39	72	1.41
C10	64	70	2.30
C11	108	67	2.63
C12	60	69	4.32
C13	40	65	1.76
C14	29	64	1.94
C15	42	74	1.96
C16	32	77	1.31
C17	14	70	0.96
C18	22	67	1.87
C19	27	76	3.37
C20	20	73	1.32
C21	69	69	1.89
C22	23	79	1.17
C23	19	75	2.07
C24	23	76	2.24
C25	20	76	2.49
C26	43	77	2.57

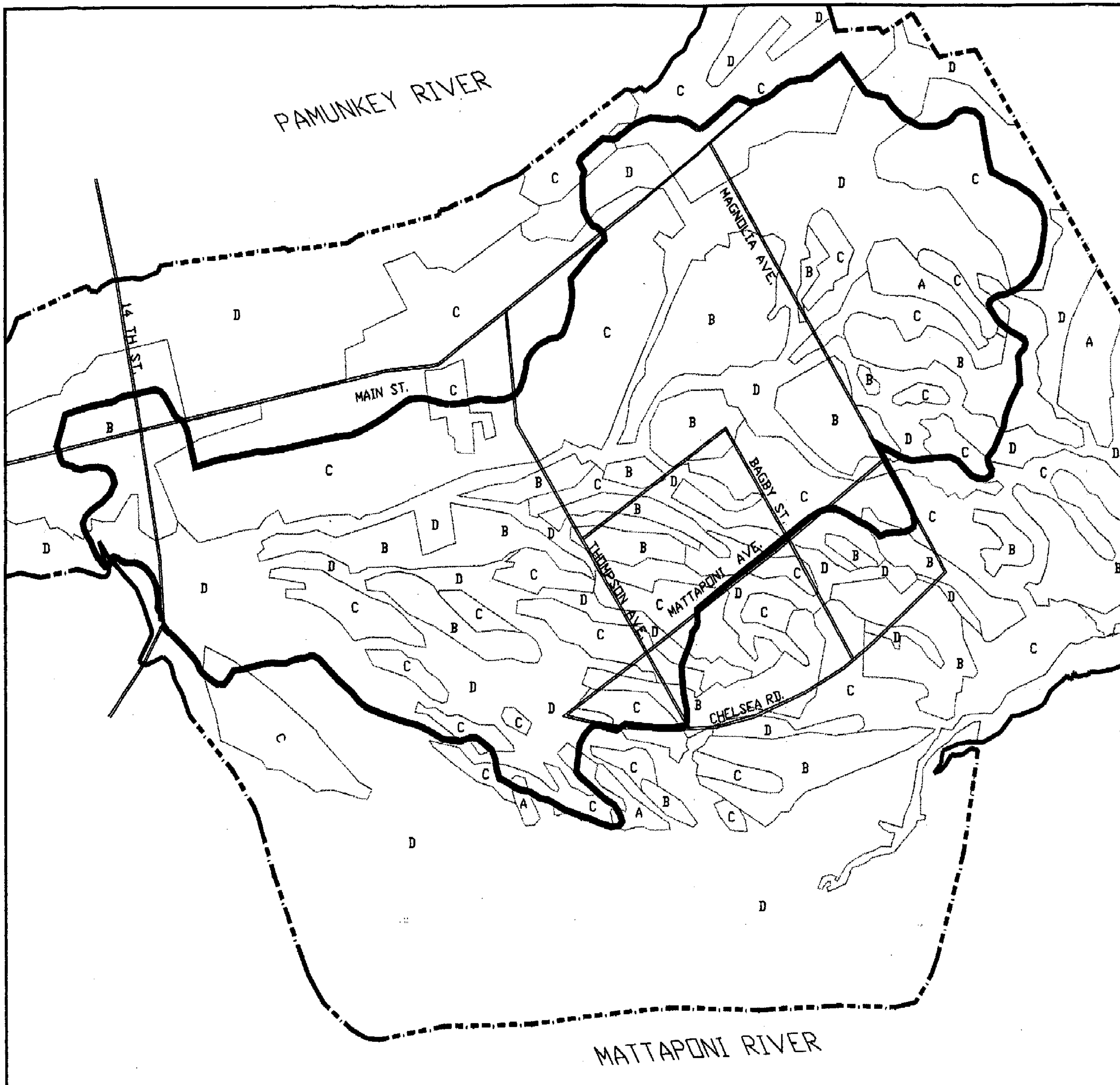


FIGURE 2

WEST POINT CREEK DRAINAGE BASIN
HYDROLOGIC SOILS CLASSIFICATION

SOILS LEGEND

A= HYDROLOGIC SOIL GROUP A
B= HYDROLOGIC SOIL GROUP B
C= HYDROLOGIC SOIL GROUP C
D= HYDROLOGIC SOIL GROUP D

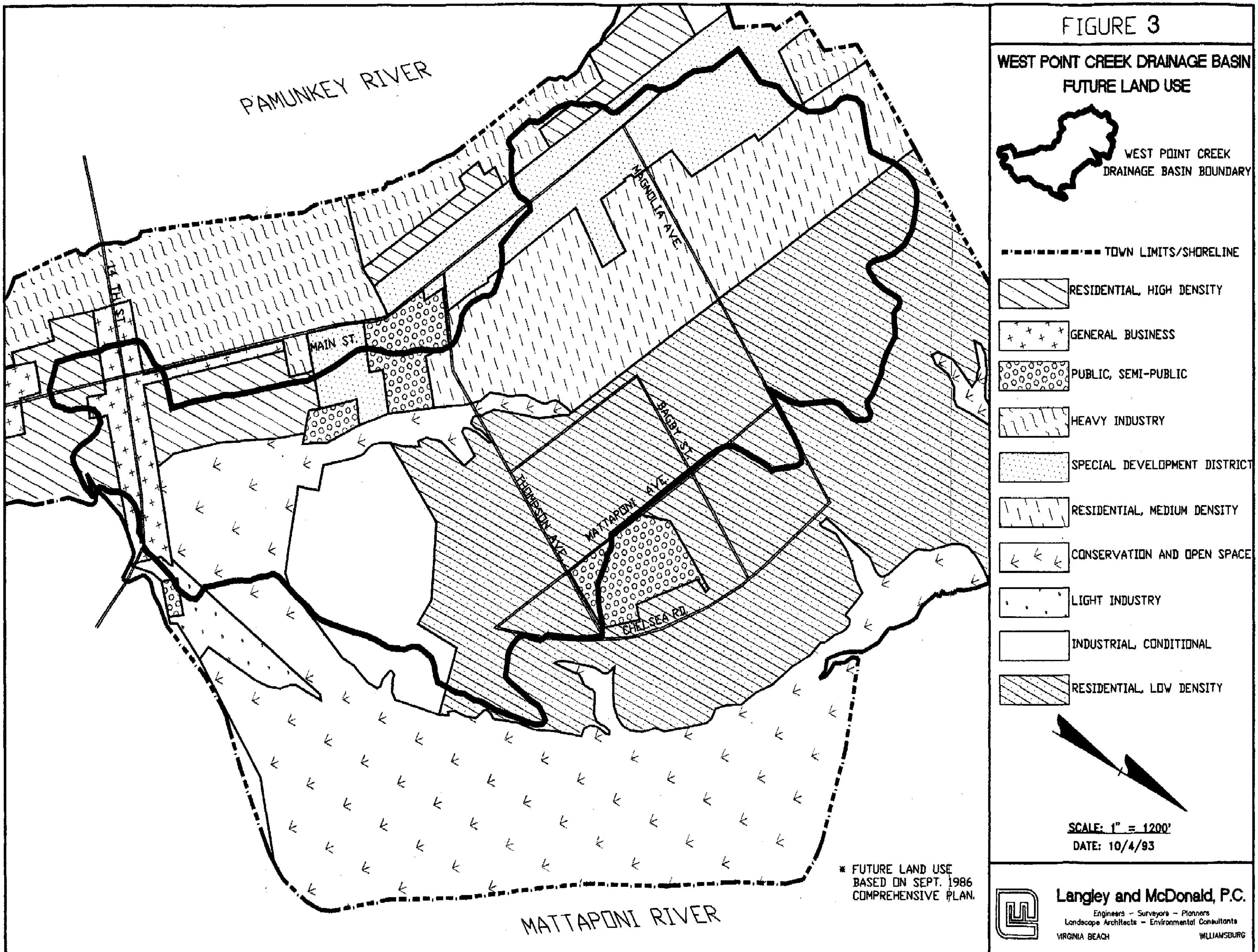
SCALE: 1" = 1200'
DATE: 10/4/93

Langley and McDonald, P.C.
Engineers – Surveyors – Planners
Landscape Architects – Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG

Table 4 West Point Creek Watershed Existing Condition Peak Flow Rates				
Sub-basin	2-YR [cfs]	10-YR [cfs]	25-YR [cfs]	100-YR [cfs]
C1	66	113	141	183
C2	31	63	82	113
C3	16	36	49	70
C4	13	33	47	69
C5	12	29	40	59
C6	14	36	49	72
C7	19	41	54	76
C8	42	87	114	157
C9	17	37	50	71
C10	17	40	55	79
C11	21	53	75	110
C12	10	23	32	46
C13	9	24	34	51
C14	5	16	22	33
C15	17	35	46	65
C16	20	39	51	69
C17	7	16	21	30
C18	5	14	20	29
C19	8	16	21	29
C20	10	22	29	40
C21	20	48	66	95
C22	17	32	41	54
C23	8	16	21	29
C24	9	19	24	34
C25	7	15	19	27
C26	16	33	43	59

Table 5
West Point Creek Watershed
Existing Drainage System Elements

Location	Description	Road Crest Elevation	Existing Capacity (cfs)	Calculated Flow Rates (cfs) Existing Conditions/Future Conditions			
				2-yr	10-yr	25-yr	100-yr
Magnolia Avenue-East	18" RCP	11.0	15	10/19	23/37	32/49	46/67
Magnolia Avenue	18" RCP	13.2	16	35/86	88/164	123/211	186/284
Magnolia Avenue-West	24" RCP	12.9	25	17/38	37/63	50/78	71/100
Thompson Avenue-East	15" RCP	9.3	6	8/20	16/36	21/46	29/62
Thompson Avenue-West	Double 42" RCP	6.3	250	101/152	185/228	224/354	386/576
ODI Street-North	18" RCP	7.8	18	20/36	39/67	51/86	69/115
ODI Street-South	15" RCP	9.8	7	7/15	16/32	21/41	30/57
Oak Lane	18" RCP	8.5	7	17/23	32/42	41/52	54/69
14th Street	Double 8.5'x 8.5'RCBC	7.4	>1000	148/222	292/383	370/508	574/836



PAMUNKEY RIVER
MATTAPONI RIVER
14 TH ST.
MAIN ST.
MAGNOLIA AVE.
BAGBY ST.
THOMPSON AVE.
MATTAPONI AVE.
CHELSEA RD.
* FUTURE LAND USE BASED ON SEPT. 1986 COMPREHENSIVE PLAN.
FIGURE 3
WEST POINT CREEK DRAINAGE BASIN
FUTURE LAND USE
WEST POINT CREEK DRAINAGE BASIN BOUNDARY
TOWN LIMITS/SHORELINE
RESIDENTIAL, HIGH DENSITY
GENERAL BUSINESS
PUBLIC, SEMI-PUBLIC
HEAVY INDUSTRY
SPECIAL DEVELOPMENT DISTRICT
RESIDENTIAL, MEDIUM DENSITY
CONSERVATION AND OPEN SPACE
LIGHT INDUSTRY
INDUSTRIAL, CONDITIONAL
RESIDENTIAL, LOW DENSITY
SCALE: 1" = 1200'
DATE: 10/4/93
Langley and McDonald, P.C.
Engineers - Surveyors - Planners
Landscape Architects - Environmental Consultants
VIRGINIA BEACH
WILLIAMSBURG

Table 6 West Point Creek Watershed Future Condition Hydrologic Parameters			
Sub-basin	Area [acres]	Curve Number	Time of Conc. [hours]
C1	50	85	0.63
C2	43	84	0.83
C3	61	77	2.14
C4	47	87	1.32
C5	33	79	0.95
C6	53	77	1.32
C7	54	77	1.46
C8	84	85	1.21
C9	39	86	1.26
C10	64	78	2.20
C11	108	81	1.98
C12	60	77	3.40
C13	40	73	1.35
C14	29	75	1.71
C15	42	77	0.93
C16	32	78	0.58
C17	14	72	0.29
C18	22	74	1.31
C19	27	80	1.32
C20	20	82	1.17
C21	69	87	1.82
C22	23	81	0.84
C23	19	95	1.77
C24	23	83	1.72
C25	20	86	2.12
C26	43	84	2.14

Table 7 West Point Creek Watershed Future Condition Peak Flow Rates				
Sub-basin	2-YR [cfs]	10-YR [cfs]	25-YR [cfs]	100-YR [cfs]
C1	73	122	150	193
C2	51	87	108	140
C3	26	53	68	93
C4	47	77	95	122
C5	29	54	69	92
C6	33	65	84	115
C7	31	61	79	107
C8	81	137	170	220
C9	38	63	78	100
C10	29	56	73	99
C11	61	112	142	189
C12	19	37	49	67
C13	19	42	55	77
C14	13	27	36	50
C15	34	65	84	113
C16	36	67	86	115
C17	15	32	41	57
C18	12	24	32	44
C19	20	36	46	62
C20	18	32	40	53
C21	53	89	110	141
C22	23	42	52	69
C23	20	30	35	44
C24	16	28	35	46
C25	13	23	28	36
C26	27	47	58	76

West Point Creek - Trouble Spots

1. Filling Operations
The drainage pattern in the area east of the King William Avenue/Magnolia Avenue intersection has recently changed. The topographic maps show a channel flowing north to south approximately 750 feet east of this intersection. An 18" culvert under Magnolia Avenue is designed to convey the channel flow from north to south. The area just south of this culvert has been disturbed by filling operations, blocking the natural north to south drainage pattern. Field investigations indicate that the channel north of Magnolia now flows in the opposite direction, eventually to a 24" culvert under Magnolia approximately 1860 feet from the Magnolia/King William intersection. The receiving channel and culvert are now serving more area than they were prior to the aforementioned filling. Other drainage patterns have been disturbed within this watershed, including areas west of Mattaponi Avenue and areas east of Chelsea Road. Drainage paths have been blocked or totally removed by filling operations on private property.

2. Unmaintained systems
The drainage ditches and culverts in several areas of this watershed, including the vicinity of the Thompson Avenue/ODI Street intersection and the Magnolia Avenue/Bond Street intersection, are overgrown with vegetation. These drainage systems need to be regularly cleaned and maintained to improve the drainage in these areas.

3. Lee Street
The east side of Lee Street from 22nd Street south to 18th Street experiences street flooding during significant storms. The drainage systems serving this area should be checked for sediment accumulation, and cleaned if necessary. The storm sewer systems and culverts should be sized to meet VDOT criteria for Lee Street.

4. Main Street/14th Street
The piped system that serves this intersection and other areas of Main Street and 14th Street is inadequate to carry runoff from significant storms, even when operating at full capacity. Field investigations reveal that this system is experiencing heavy root penetration and sediment build-up. The trunk line changes size from 12" to 6" at the Main Street/13th Street intersection. These factors significantly reduce the capacity of this system.

5. Bagby Street
Water drains to a natural low area off Bagby Street west of Mattaponi Avenue. No culvert exists to drain this water under Bagby Street, nor is there a downstream receiving channel to convey the water away from Bagby Street.

   The Bagby Street/Mattaponi Avenue intersection is also a low spot to which the surrounding water drains, but no outfall exists.

6. Thompson Avenue
The existing system serving Thompson Avenue at the school is inadequate. Further

discussions of this problem area are found later is this section under "TROUBLE SPOTS".

7. Mattaponi Avenue
There is no culvert at the low spot on Mattaponi Avenue north of Bagby Street to drain water away from the road, nor is there an adequate receiving channel to carry runoff away from this area.

The culvert under Mattaponi Avenue south of Bagby and the receiving channels have not been maintained, preventing adequate drainage in this area. Additional information on this trouble spot are found later in this section under "TROUBLE SPOTS".

Magnolia Tributary to Mattaponi River - Existing Conditions

The Magnolia Tributary to the Mattaponi River (see Figure 4) drains approximately 121 acres of land. Land uses within this watershed include single family residential, agricultural, institutional, and undeveloped.

The Magnolia watershed was divided into three sub-basins for hydrologic analysis. Figure 4 shows sub-basin delineations. Hydrologic parameters developed for each sub-basin are shown in Table 8.

Figure 5 shows the hydrologic soil groups present in this watershed. As seen from Figure 5, soil groups B, C, and D are represented.

The Magnolia watershed was analyzed under current conditions in the 2-, 10-, 25-, and 100-year events. Table 9 shows the calculated peak flow rates for each sub-basin.

Table 10 describes selected system elements and provides estimated peak flow capacities and road crest elevations.

Magnolia Tributary to Mattaponi River - Future Conditions

To estimate the impacts of future development, hydrologic parameters were developed for the sub-basin assuming full development of the watershed based on the Town's 1986 Comprehensive Land Use Plan. This assumption implies that areas that are currently undeveloped will ultimately be developed to allowable densities, and that areas where densities are lower than allowable will be further densified by future development.

Figure 6 represents future land use patterns for the Magnolia watershed. If land use patterns change significantly, the results of this study must be reevaluated.

Future hydrologic parameters used as a basis for modeling are shown in Table 11. Table 12 shows the results of the 2-, 10-, 25-, and 100-year storm analyses.

Magnolia Tributary to Mattaponi River - Trouble Spots

1. Ponding at school
   See discussions later in this section under "TROUBLE SPOTS".

2. Depressions
   There are several areas within this watershed where water drains to an existing low spot with no topographic relief. The topographic maps show depression areas north and south of Chelsea Road. The water ponds until it either evaporates or infiltrates into the ground.

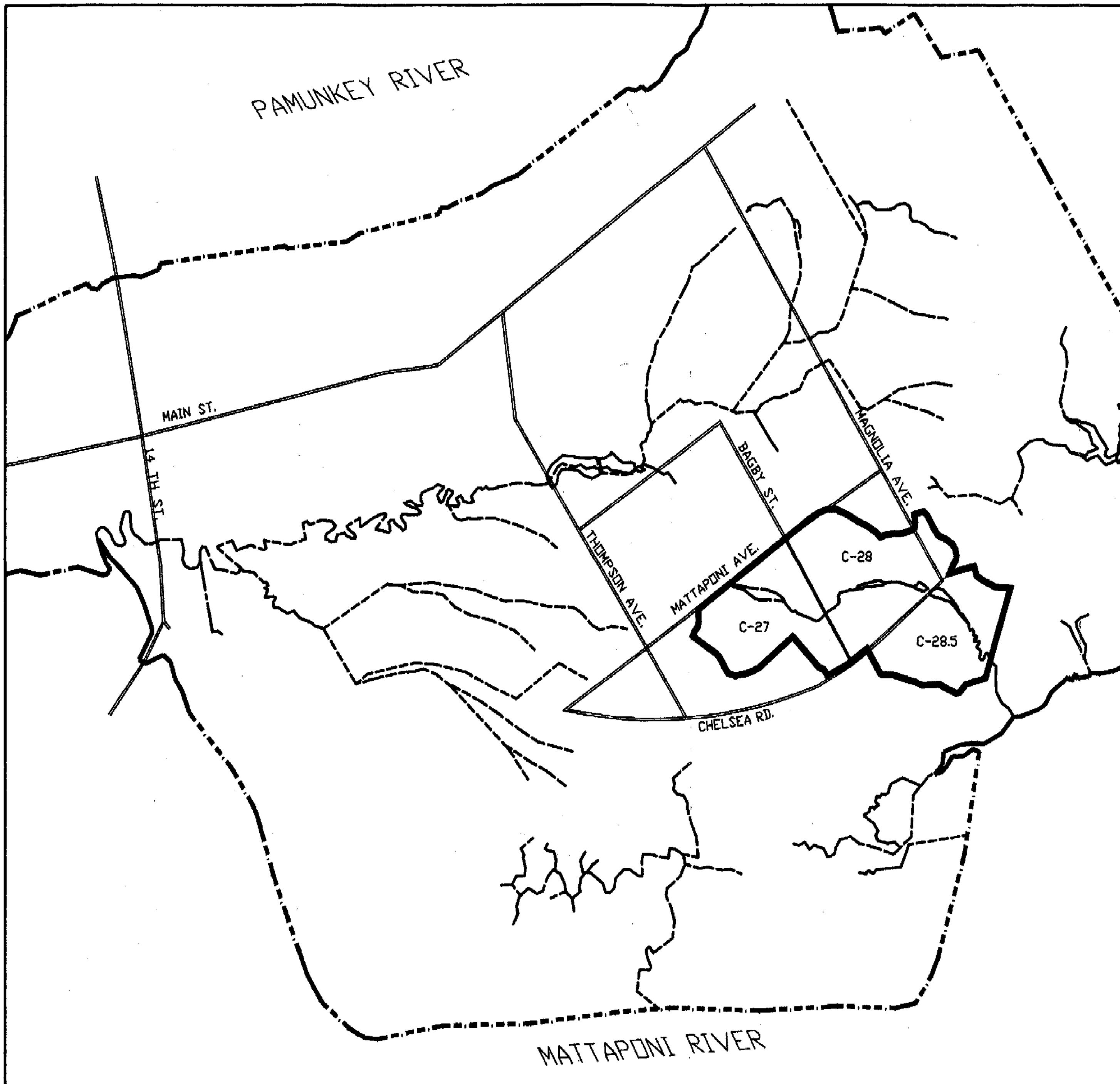


FIGURE 4

MAGNOLIA AVE. TRIBUTARY DRAINAGE BASIN BASIN MAP

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Landscape Architects – Environmental Consultants
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Table 8 Magnolia Watershed Existing Condition Hydrologic Parameters			
Sub-basin	Area [acres]	Curve Number	Time of Conc. [hours]
C27	38	78	2.01
C28	47	73	1.20
C285	35	66	1.31

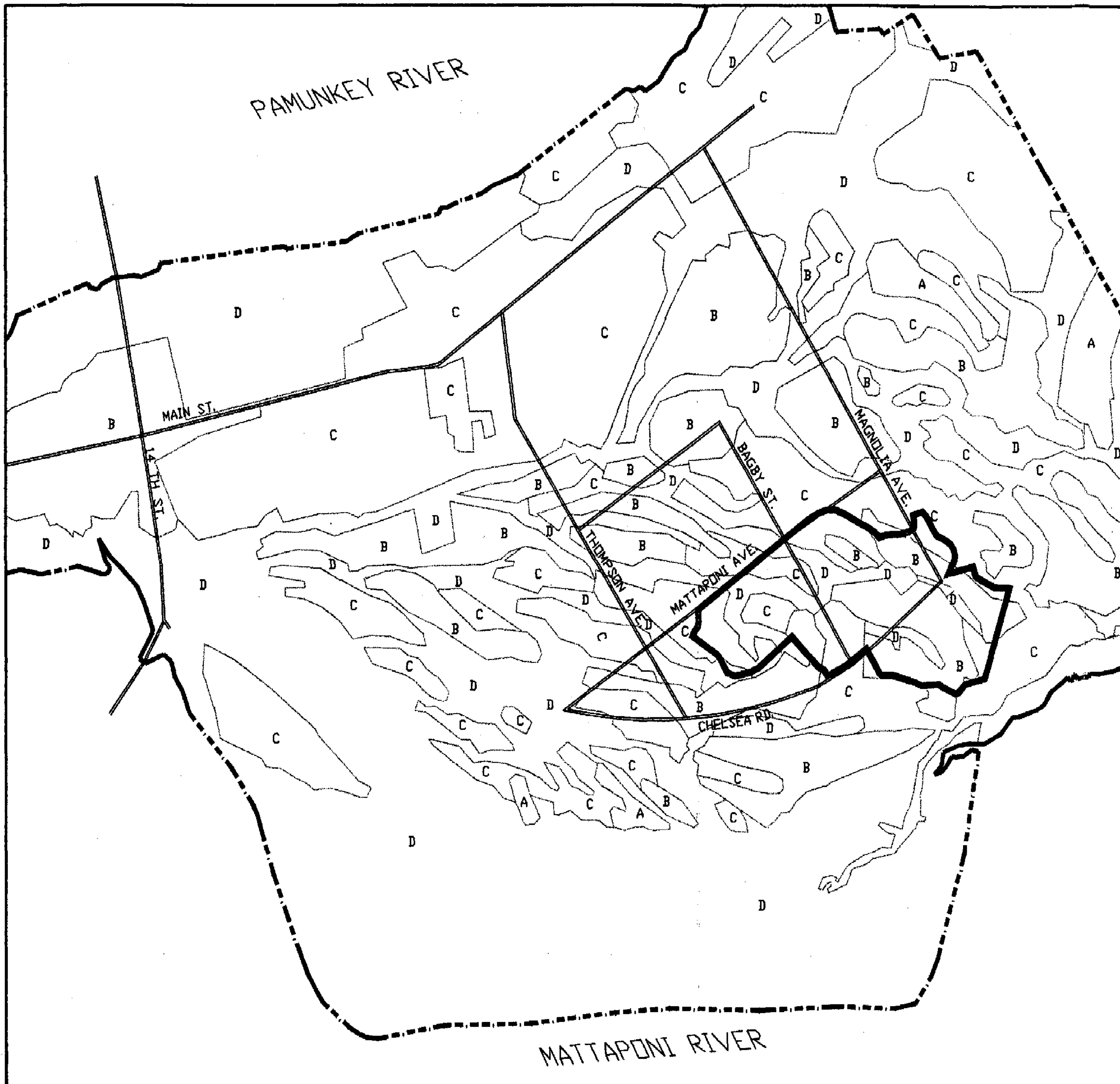

FIGURE 5

MAGNOLIA AVE. TRIBUTARY DRAINAGE BASIN HYDROLOGIC SOILS CLASSIFICATION

MAGNOLIA AVENUE TRIBUTARY DRAINAGE BASIN BOUNDARY

TOWN LIMITS/SHORELINE

SOILS LEGEND

A= HYDROLOGIC SOIL GROUP A
B= HYDROLOGIC SOIL GROUP B
C= HYDROLOGIC SOIL GROUP C
D= HYDROLOGIC SOIL GROUP D

SCALE: 1" = 1200'

DATE: 10/4/93

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Landscape Architects – Environmental Consultants
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Table 9 Magnolia Watershed Existing Condition Peak Flow Rates				
Sub-basin	2-YR [cfs]	10-YR [cfs]	25-YR [cfs]	100-YR [cfs]
C27	18	35	46	62
C28	25	54	71	99
C285	11	28	39	58

Table 10
Magnolia Watershed
Existing Drainage System Elements

Location	Description	Road Crest Elevation	Existing Capacity (cfs)	Calculated Flow Rates (cfs) Existing Conditions/Future Conditions			
				2-yr	10-yr	25-yr	100-yr
Chelsea Road south of Magnolia Avenue (R28)	36" RCP	6.6	75	31/45	54/69	67/100	101/167
Bagby St. west of Chelsea Rd. (R27)				18/40	35/71	46/89	62/117

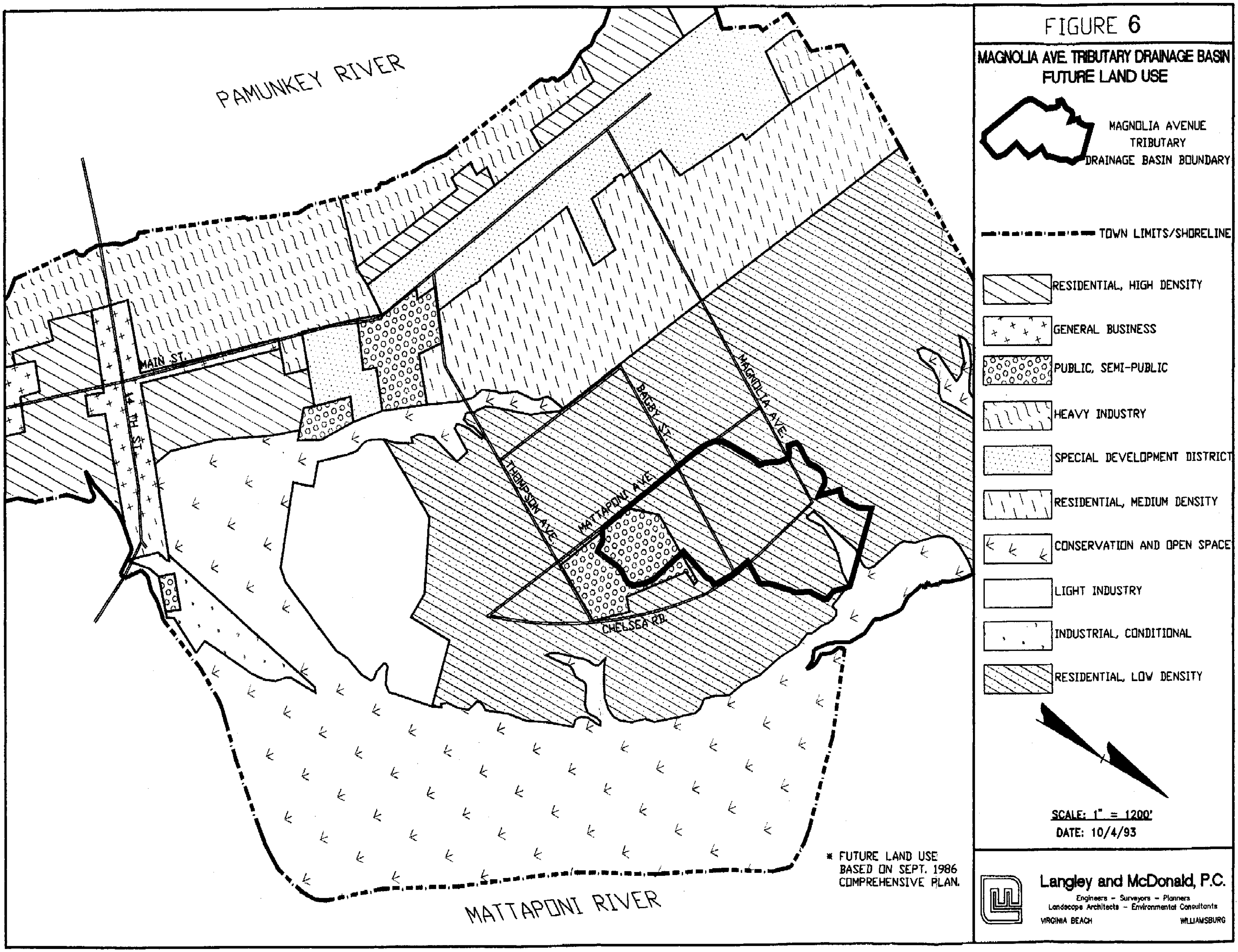


FIGURE 6
MAGNOLIA AVE. TRIBUTARY DRAINAGE BASIN
FUTURE LAND USE
MAGNOLIA AVENUE TRIBUTARY DRAINAGE BASIN BOUNDARY
TOWN LIMITS/SHORELINE
RESIDENTIAL, HIGH DENSITY
GENERAL BUSINESS
PUBLIC, SEMI-PUBLIC
HEAVY INDUSTRY
SPECIAL DEVELOPMENT DISTRICT
RESIDENTIAL, MEDIUM DENSITY
CONSERVATION AND OPEN SPACE
LIGHT INDUSTRY
INDUSTRIAL, CONDITIONAL
RESIDENTIAL, LOW DENSITY
SCALE: 1" = 1200'
DATE: 10/4/93
Langley and McDonald, P.C.
Engineers - Surveyors - Planners
Landscape Architects - Environmental Consultants
VIRGINIA BEACH
WILLIAMSBURG
PAMUNKEY RIVER
MATTAPONI RIVER
MAIN ST.
14 TH ST.
THOMPSON AVE.
MATTAPONI AVE.
BAGBY ST.
MAGNOLIA AVE.
CHELSEA RD.
* FUTURE LAND USE BASED ON SEPT. 1986 COMPREHENSIVE PLAN.

Table 11 Magnolia Watershed Future Condition Hydrologic Parameters			
Sub-basin	Area [acres]	Curve Number	Time of Conc. [hours]
C27	38	82	0.86
C28	47	75	0.93
C285	35	71	0.92

Table 12 Magnolia Watershed Future Condition Peak Flow Rates				
Sub-basin	2-YR [cfs]	10-YR [cfs]	25-YR [cfs]	100-YR [cfs]
C27	40	71	89	117
C28	34	68	89	122
C285	20	44	59	83

North Chelsea Tributary to Mattaponi River - Existing Conditions

The North Chelsea Tributary to the Mattaponi River (see Figure 7) drains approximately 424 acres of land, including 227 acres which is beyond the Town limits. Land uses within this watershed include single family residential, agricultural, and undeveloped.

The North Chelsea watershed was divided into 6 sub-basins for hydrologic analysis. Figure 7 shows sub-basin delineations. Hydrologic parameters developed for each sub-basin are shown in Table 13.

Figure 8 shows the hydrologic soil groups present in this watershed. As seen from Figure 8, all four soil groups are represented.

The North Chelsea watershed was analyzed under current conditions in the 2-, 10-, 25-, and 100-year events. Table 14 shows calculated peak flow rates for each sub-basin.

Table 15 describes selected system elements and provides estimated peak flow capacities and road crest elevations.

North Chelsea Tributary to Mattaponi River - Future Conditions

To estimate the impacts of future development, hydrologic parameters were developed for the sub-basin assuming full development of the watershed based on the Town's 1986 Comprehensive Land Use Plan. This assumption implies that areas that are currently undeveloped will ultimately be developed to allowable densities, and that areas where densities are lower than allowable will be further densified by future development.

Figure 9 represents future land use patterns for the North Chelsea watershed. If land use patterns change significantly, the results of this study must be reevaluated.

Future hydrologic parameters used as a basis for modeling are shown in Table 16. Table 17 shows the results of the 2-, 10-, 25-, and 100-year storm analyses.

North Chelsea Tributary to Mattaponi River - Trouble Spots

1. Chelsea Road north of Riverview
   The downstream end of the 12" culvert under Chelsea Road north of Riverview is buried. Without the culvert, water must pass over Chelsea Road to enter the downstream receiving ditch.

2. Depressions
   As in other portions of the Town, there are areas within this watershed where water drains to an existing low spot with no topographic relief. The topographic maps show several such areas north of Chelsea Road between Magnolia Avenue and the tributary. The water ponds until it either evaporates or infiltrates into the ground.

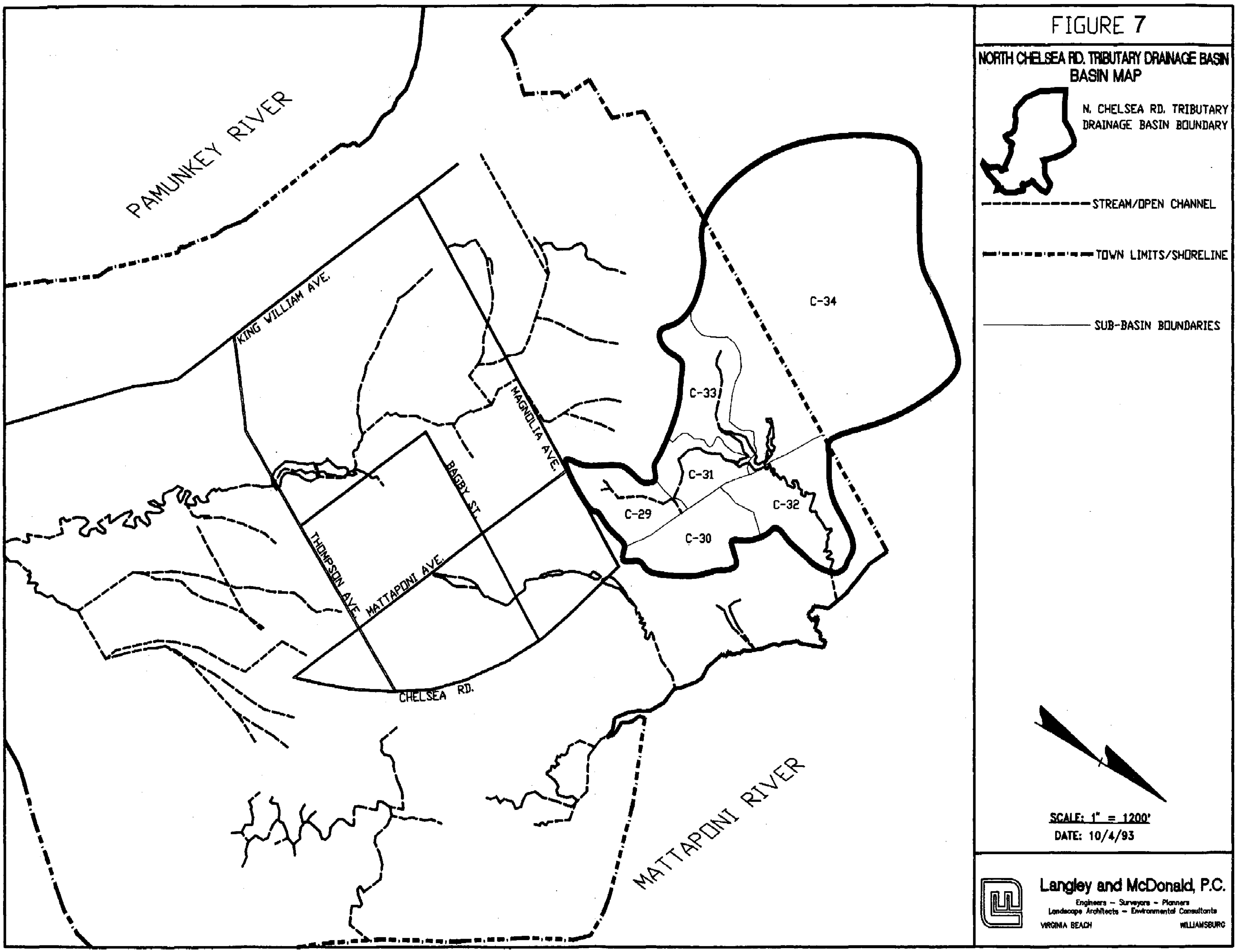


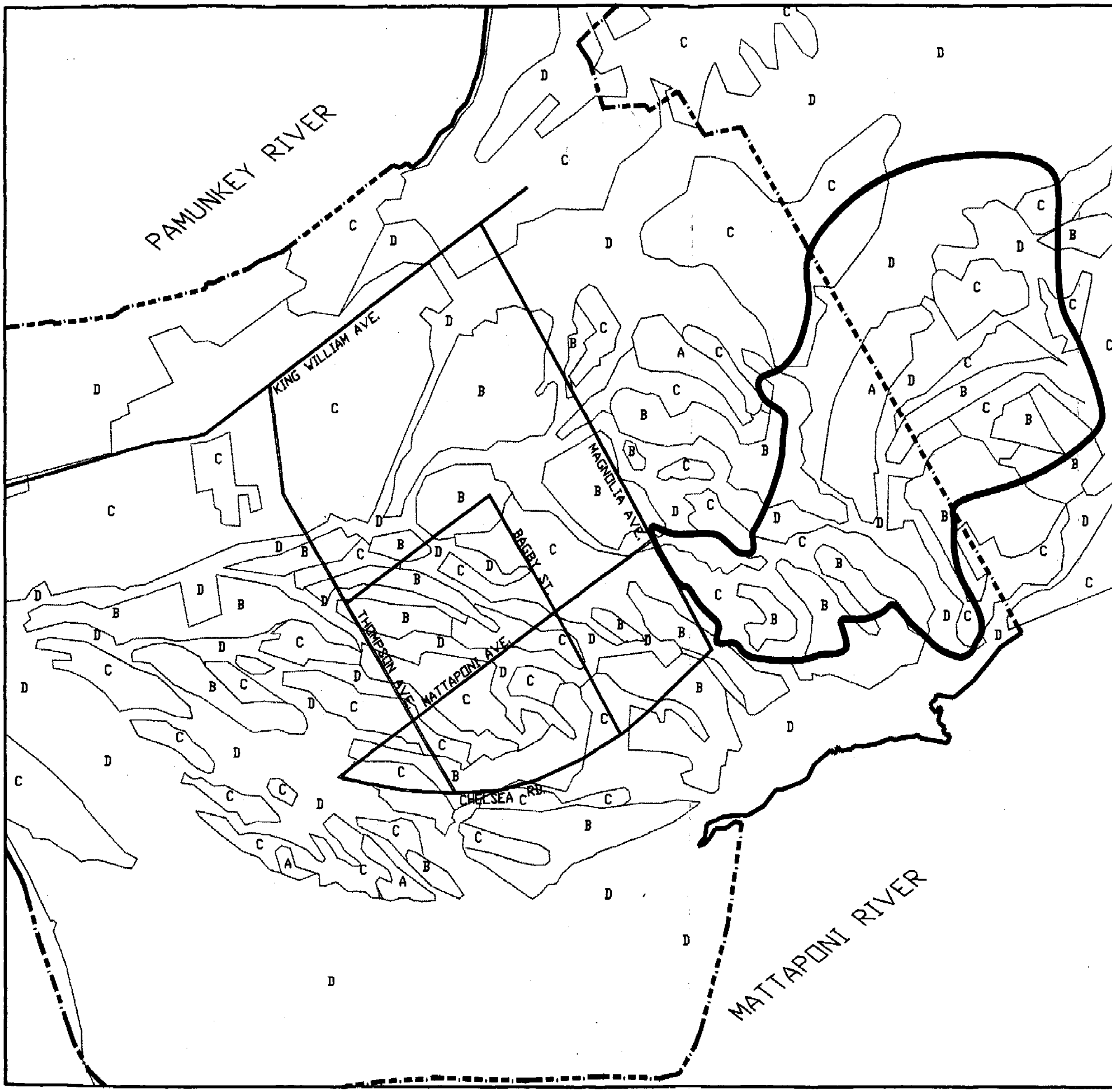
FIGURE 7

NORTH CHELSEA RD. TRIBUTARY DRAINAGE BASIN
BASIN MAP

Table 13 North Chelsea Watershed Existing Condition Hydrologic Parameters			
Sub-basin	Area [acres]	Curve Number	Time of Conc. [hours]
C29	25	69	1.12
C30	30	71	1.68
C31	20	64	1.26
C32	40	68	1.69
C33	32	52	1.80
C34	277	67	2.19

FIGURE 8

NORTH CHELSEA RD. TRIBUTARY DRAINAGE BASIN HYDROLOGIC SOILS CLASSIFICATION



N. CHELSEA RD. TRIBUTARY DRAINAGE BASIN BOUNDARY

TOWN LIMITS/SHORELINE

SOILS LEGEND

A= HYDROLOGIC SOIL GROUP A
B= HYDROLOGIC SOIL GROUP B
C= HYDROLOGIC SOIL GROUP C
D= HYDROLOGIC SOIL GROUP D

SCALE: 1" = 1200'
DATE: 10/4/93

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Engineers – Surveyors – Planners
Landscape Architects – Environmental Consultants
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Table 14 North Chelsea Watershed Existing Condition Peak Flow Rates				
Sub-basin	2-YR [cfs]	10-YR [cfs]	25-YR [cfs]	100-YR [cfs]
C29	11	25	34	49
C30	11	25	34	48
C31	5	15	21	31
C32	12	29	40	59
C33	1	8	13	24
C34	62	158	221	324

Table 15
North Chelsea Watershed
Existing Drainage System Elements

Location	Description	Road Crest Elevation	Existing Capacity (cfs)	Calculated Flow Rates (cfs) Existing Conditions/Future Conditions			
				2-yr	10-yr	25-yr	100-yr
Chelsea Road north of Riverview Dr. (R30)	12" RCP	10.5	0 - buried outfall	11/26	25/54	34/72	48/100
Chelsea Road north of Euclid Blvd. (R33)	8'x 2' culvert	3.2	50	47/83	101/335	239/469	390/672

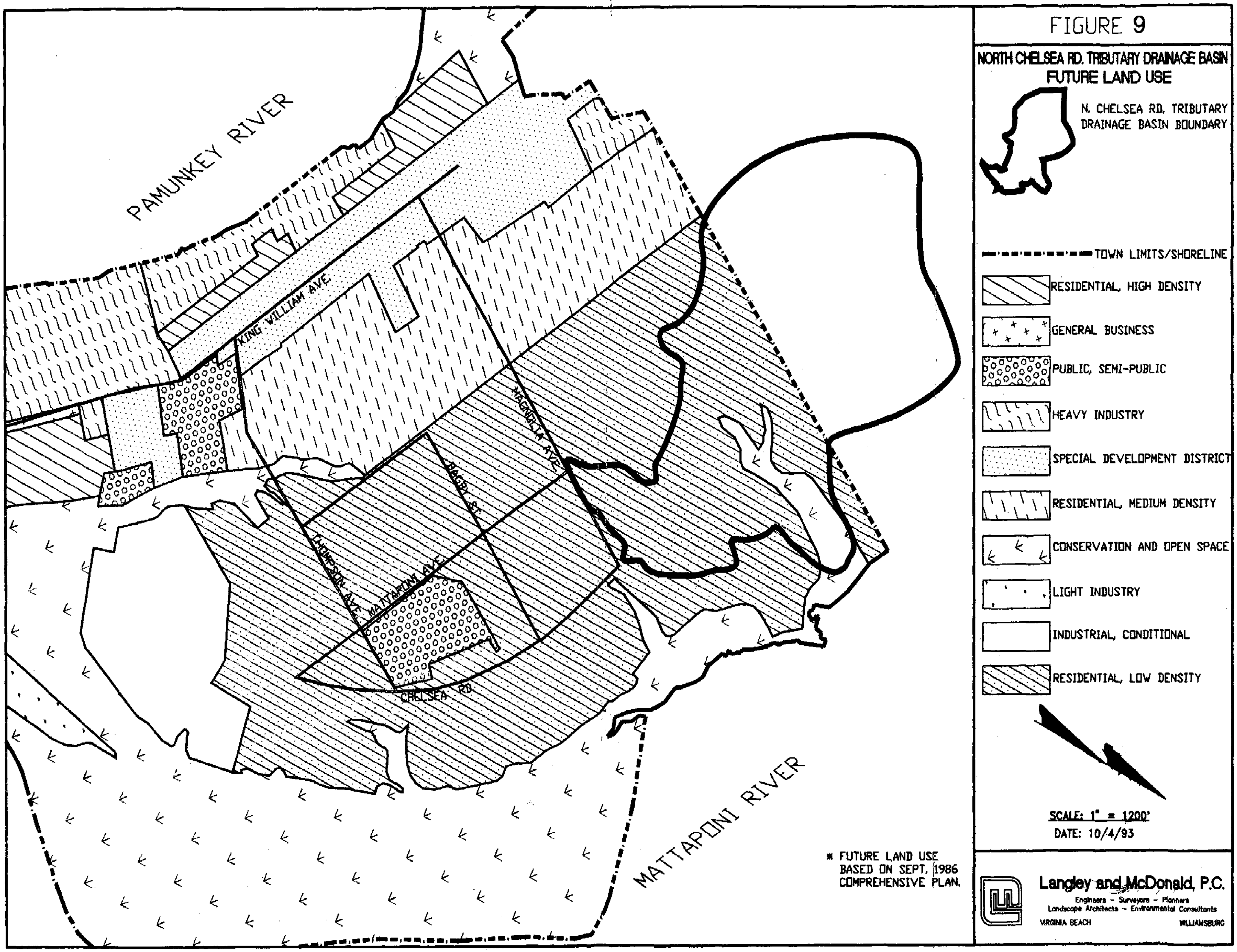
PAMUNKEY RIVER
MATTAPONI RIVER
KING WILLIAM AVE.
MAGNOLIA AVE.
BAGBY ST.
THOMPSON AVE.
MATTAPONI AVE.
CHELSEA RD.
FIGURE 9
NORTH CHELSEA RD. TRIBUTARY DRAINAGE BASIN
FUTURE LAND USE
N. CHELSEA RD. TRIBUTARY DRAINAGE BASIN BOUNDARY
TOWN LIMITS/SHORELINE
RESIDENTIAL, HIGH DENSITY
GENERAL BUSINESS
PUBLIC, SEMI-PUBLIC
HEAVY INDUSTRY
SPECIAL DEVELOPMENT DISTRICT
RESIDENTIAL, MEDIUM DENSITY
CONSERVATION AND OPEN SPACE
LIGHT INDUSTRY
INDUSTRIAL, CONDITIONAL
RESIDENTIAL, LOW DENSITY
SCALE: 1" = 1200'
DATE: 10/4/93
* FUTURE LAND USE BASED ON SEPT. 1986 COMPREHENSIVE PLAN.
Langley and McDonald, P.C.
Engineers - Surveyors - Planners
Landscape Architects - Environmental Consultants
VIRGINIA BEACH
WILLIAMSBURG

Table 16 North Chelsea Watershed Future Condition Hydrologic Parameters			
Sub-basin	Area [acres]	Curve Number	Time of Conc. [hours]
C29	25	80	0.89
C30	30	72	0.51
C31	20	78	1.03
C32	40	78	1.52
C33	32	75	1.34
C34	277	78	1.56

Table 17 North Chelsea Watershed Future Condition Peak Flow Rates				
Sub-basin	2-YR [cfs]	10-YR [cfs]	25-YR [cfs]	100-YR [cfs]
C29	24	43	55	73
C30	26	54	72	100
C31	21	35	44	57
C32	24	46	60	81
C33	18	36	48	65
C34	161	311	402	543

Thompson Tributary to Mattaponi River - Existing Conditions

The Thompson Tributary to the Mattaponi River (see Figure 10) drains approximately 107 acres of land. Land uses within this watershed include single family residential, institutional, agricultural, and undeveloped.

The Thompson watershed was divided into six sub-basins for hydrologic analysis. Figure 10 shows sub-basin delineations. Hydrologic parameters developed for each sub-basin are shown in Table 18.

Figure 11 shows the hydrologic soil groups present in this watershed. As seen from Figure 11, all four soil groups are represented.

The Thompson watershed was analyzed under current conditions in the 2-, 10-, 25-, and 100-year events. Table 19 shows the calculated peak flow rates for each sub-basin.

Table 20 describes selected system elements and provides estimated peak flow capacities and road crest elevations.

Thompson Tributary to Mattaponi River - Future Conditions

To estimate the impacts of future development, hydrologic parameters were developed for the sub-basin assuming full development of the watershed based on the Town's 1986 Comprehensive Land Use Plan. This assumption implies that areas that are currently undeveloped will ultimately be developed to allowable densities, and that areas where densities are lower than allowable will be further densified by future development.

Figure 12 represents future land use patterns for the Thompson watershed. If land use patterns change significantly, the results of this study must be reevaluated.

Future hydrologic parameters used as a basis for modeling are shown in Table 21. Table 22 shows the results of the 2-, 10-, 25-, and 100-year storm analyses.

Thompson Tributary to Mattaponi River - Trouble Spots

1. School parking lot
   See discussions found later in this section under "TROUBLE SPOTS".

2. Unmaintained ditches/private property
   Many sections of open ditch in this watershed flow through private property where no regular maintenance of the ditch sections occurs. In addition to reducing flow capacity, the lack of ditch maintenance oftentimes creates a nuisance.

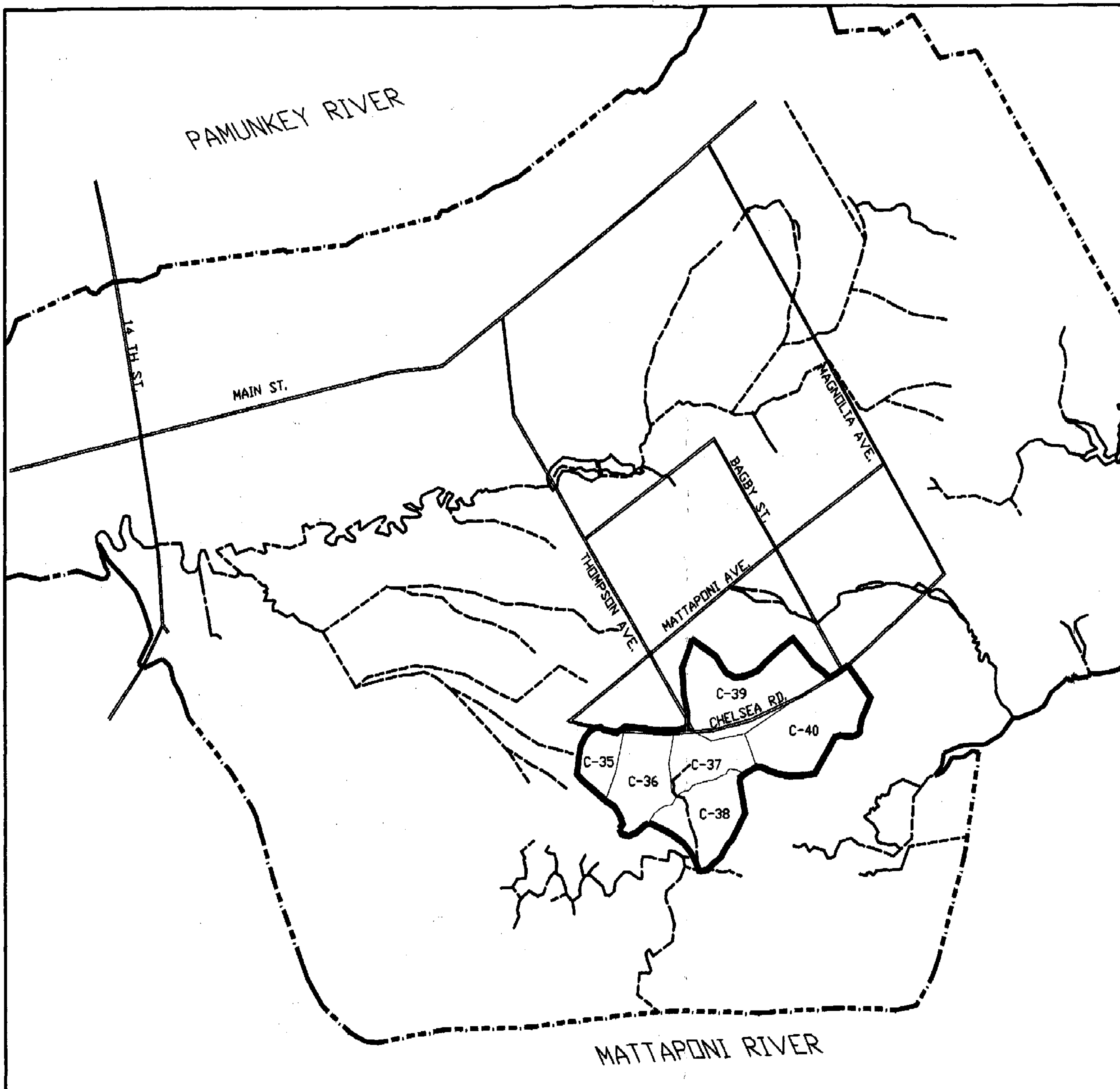

FIGURE 10

THOMPSON AVE. TRIBUTARY DRAINAGE BASIN BASIN MAP

THOMPSON AVENUE TRIBUTARY DRAINAGE BASIN BOUNDARY

STREAM/OPEN CHANNEL

TOWN LIMITS/SHORELINE

SUB-BASIN BOUNDARY

SCALE: 1" = 1200'

DATE: 10/4/93

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Table 18 Thompson Watershed Existing Condition Hydrologic Parameters			
Sub-basin	Area [acres]	Curve Number	Time of Conc. [hours]
C35	8	82	0.89
C36	17	79	1.9
C37	12	70	0.86
C38	18	69	1.86
C39	29	85	1.56
C40	24	72	2.32

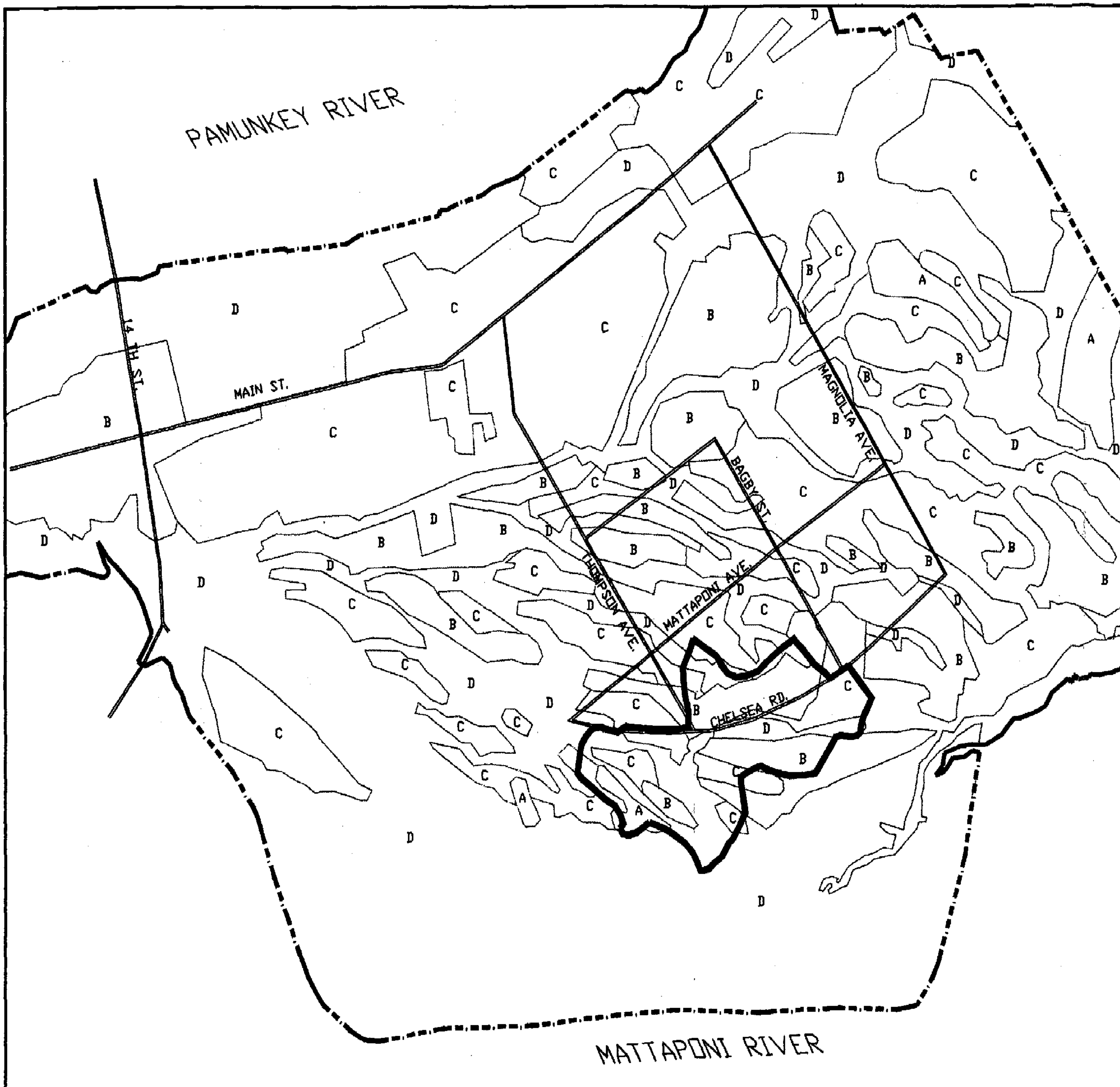

FIGURE 11

THOMPSON AVE. TRIBUTARY DRAINAGE BASIN HYDROLOGIC SOILS CLASSIFICATION

THOMPSON AVENUE TRIBUTARY DRAINAGE BASIN BOUNDARY

TOWN LIMITS/SHORELINE

SOILS LEGEND

A= HYDROLOGIC SOIL GROUP A
B= HYDROLOGIC SOIL GROUP B
S HYDROLOGIC SOIL GROUP C
D= HYDROLOGIC SOIL GROUP D

SCALE: 1" = 1200'
DATE: 10/4/93

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Table 19 Thompson Watershed Existing Condition Peak Flow Rates				
Sub-basin	2-YR [cfs]	10-YR [cfs]	25-YR [cfs]	100-YR [cfs]
C35	8	14	18	23
C36	9	17	22	30
C37	7	15	21	29
C38	5	13	17	25
C39	23	40	49	64
C40	7	16	22	31

Table 20
Thompson Watershed
Existing Drainage System Elements

Location	Description	Road Crest Elevation	Existing Capacity (cfs)	Calculated Flow Rates (cfs) Existing Conditions/Future Conditions			
				2-yr	10-yr	25-yr	100-yr
Chelsea Road north of Thompson Avenue @ elem. school (R39)	12" RCP	9.1	5	23/31	40/59	49/76	64/102

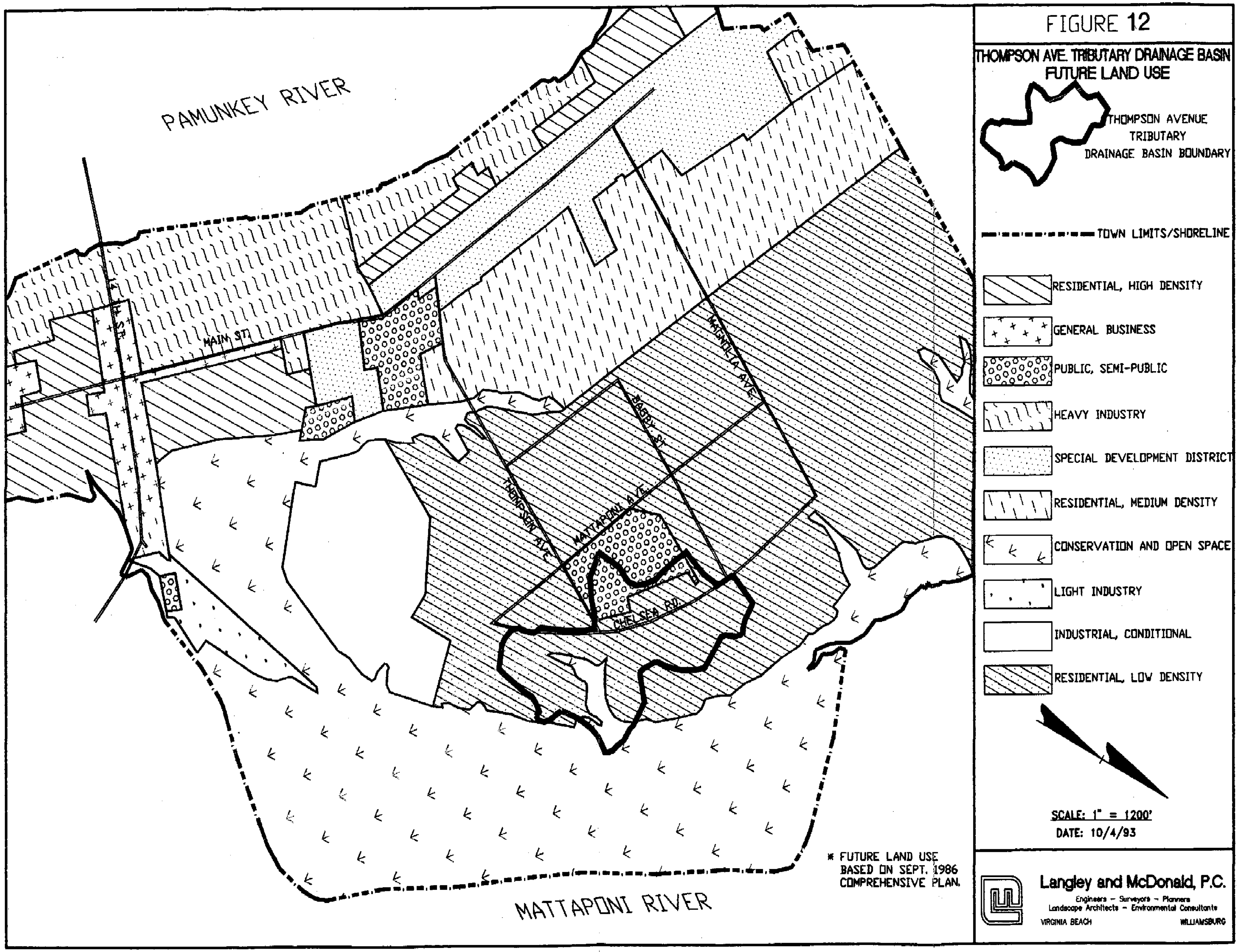
PAMUNKEY RIVER
MATTAPONI RIVER
MAIN ST.
14 ST.
THOMPSON AVE.
MATTAPONI AVE.
BAGBY ST.
MAGNOLIA AVE.
CHELSEA RD.
* FUTURE LAND USE
BASED ON SEPT. 1986
COMPREHENSIVE PLAN.
FIGURE 12
THOMPSON AVE. TRIBUTARY DRAINAGE BASIN
FUTURE LAND USE
THOMPSON AVENUE
TRIBUTARY
DRAINAGE BASIN BOUNDARY
TOWN LIMITS/SHORELINE
RESIDENTIAL, HIGH DENSITY
GENERAL BUSINESS
PUBLIC, SEMI-PUBLIC
HEAVY INDUSTRY
SPECIAL DEVELOPMENT DISTRICT
RESIDENTIAL, MEDIUM DENSITY
CONSERVATION AND OPEN SPACE
LIGHT INDUSTRY
INDUSTRIAL, CONDITIONAL
RESIDENTIAL, LOW DENSITY
SCALE: 1" = 1200'
DATE: 10/4/93
Langley and McDonald, P.C.
Engineers – Surveyors – Planners
Landscape Architects – Environmental Consultants
VIRGINIA BEACH
WILLIAMSBURG

Table 21 Thompson Watershed Future Condition Hydrologic Parameters			
Sub-basin	Area [acres]	Curve Number	Time of Conc. [hours]
C35	8	82	0.65
C36	17	82	1.53
C37	12	75	0.76
C38	18	80	1.23
C39	29	76	0.53
C40	24	74	0.74

Table 22 Thompson Watershed Future Condition Peak Flow Rates				
Sub-basin	2-YR [cfs]	10-YR [cfs]	25-YR [cfs]	100-YR [cfs]
C35	10	17	21	28
C36	12	22	28	37
C37	10	20	26	35
C38	14	25	32	43
C39	31	59	76	102
C40	19	39	51	70

4.3 WATER QUALITY MODELING

The Town is divided into two watersheds for the purpose of documenting results of the water quality calculations, namely the watersheds of the Pamunkey River and the Mattaponi River (see Figure 13). As prescribed by the Chesapeake Bay Local Assistance Department, average existing land cover conditions were determined for each of the two watersheds based on land use. Phosphorus loadings as a function of land use are shown in Table 23. Weighted averages of phosphorus export for each watershed were calculated based on existing land uses, excluding various undevelopable marsh/wetland areas as shown in Figure 13. The Mattaponi watershed has an average existing phosphorus export of 0.82 lb/acre/year corresponding to an equivalent impervious cover percentage of 34. The Pamunkey watershed has an average existing phosphorus export of 1.06 lb/acre/year corresponding to an equivalent impervious cover percentage of 45.

These average land cover conditions set the threshold by which future development may have to provide for water quality controls under the Chesapeake Bay Preservation regulations. If the percentage of impervious cover for a development project is kept below the threshold level for that watershed where the development takes place, then no stormwater quality controls are needed. For example, if a developer wants to build a subdivision in the Mattaponi River watershed, then no stormwater quality controls are needed as long as the average percent of impervious cover does not exceed 34 percent of the total development site.

Phosphorus loading calculations were also made considering the impact of future land uses. The Mattaponi watershed has an average future phosphorus export of 0.77 lb/acre/year corresponding to an equivalent percent impervious cover of 31. The Pamunkey watershed has an average future phosphorus export of 1.28 lb/acre/year corresponding to an equivalent percent impervious cover of 55. As this figure is greater than the allowable 45 percent, development controls will be necessary or stormwater quality BMP's will be required.

Detailed printouts of the water quality calculations are provided in Appendix 3.

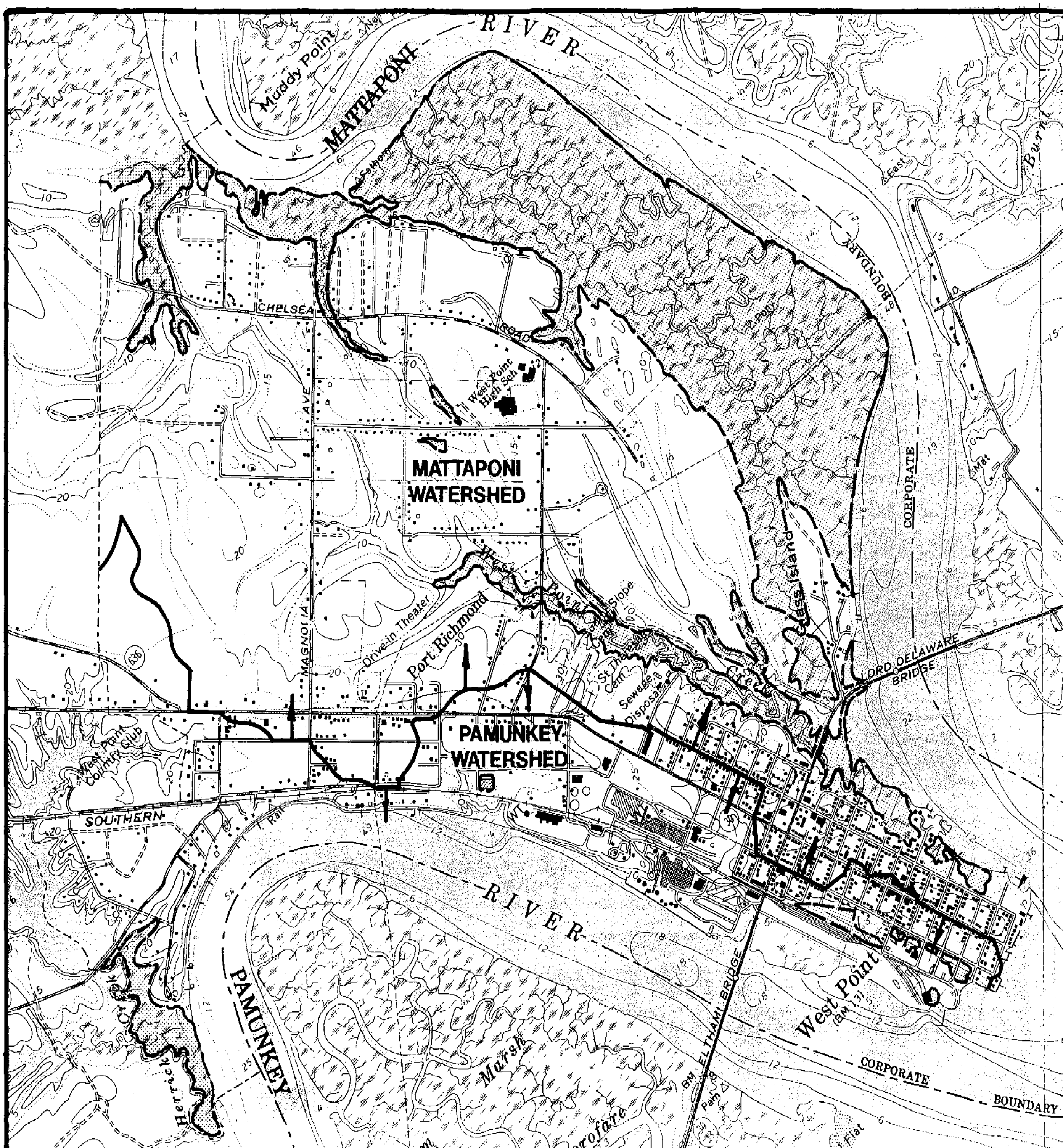

FIGURE 13

WATERSHED DELINEATION FOR WATER QUALITY CALCULATIONS


UNDEVELOPABLE AREAS ACCOUNTED FOR IN CALCULATIONS

BASE INFORMATION TAKEN FROM U.S.G.S. WEST POINT, VIRGINIA QUADRANGLE
37076-E7-TF-024 PHOTOREVISED 1986

SCALE: 1"=1500'
DATE:10/11/93

Langley and McDonald, P.C.
Engineers – Surveyors – Planners
Landscape Architects – Environmental Consultants
VIRGINIA BEACH WILLIAMSBURG

Table 23 ANNUAL STORM PHOSPHORUS EXPORT* For Existing Developed Land Uses		
LAND USES	IMPERVIOUS COVER (%)	PHOSPHORUS EXPORT (lbs/ac/yr)
	0	0.12
5.0 acre residential lots	5	0.22
2.0 acre residential lots	10	0.33
1.0 acre residential lots	15	0.43
	16	0.45
	17	0.47
	18	0.49
	19	0.52
0.50 acre residential lots	20	0.54
0.33 acre residential lots	25	0.64
0.25 acre residential lots	30	0.75
	35	0.85
Townhouses	40	0.96
	45	1.06
	50	1.17
Garden Apartments	55	1.27
	60	1.38
	65	1.48
Light	70	1.59
Commercial/Industrial	75	1.69
	80	1.80
Heavy	85	1.90
Commercial/Industrial	90	2.01
	95	2.11
Asphalt/Pavement	100	2.22

* Based on annual rainfall of 44 inches per year

Table 24 ANNUAL STORM PHOSPHORUS EXPORT For Non-Developed Land Uses				
	HYDROLOGIC SOIL GROUP			
LAND USE	A	B	C	D
Conventional Tillage Cropland	0.83	1.63	2.42	3.71
Conservation Tillage Cropland	0.52	1.02	1.52	2.32
Pasture Land	0.20	0.40	0.59	0.91
Forest Land	0.04	0.08	0.12	0.19

4.4 TROUBLE SPOTS

The Town identified five specific areas where drainage was inadequate. Brief descriptions of these trouble spots are presented below, with recommended improvements provided in Section Five. The improvements mentioned in this report represent a concept only. Other trouble spots discovered during this study have been previously discussed. Detailed analysis and design, outside the scope of this study, are required for actual implementation.

7th Street and Main Street

The existing drainage system serving this area is inadequate in size and, therefore, cannot carry runoff from significant rainfall events. In addition, this system outfalls to an existing marsh area at the intersection of 6th Street and Kirby Street, and the outfall has a tendency to become filled with sediment and debris. This outfall was buried at the time of our initial field inspection.

23rd Street and King William Avenue

The existing drainage system serving this area runs along King William Avenue from Bellwood Street to 16th Street where it empties into an open ditch at Chesapeake Corporation. This system can not carry the design storm runoff from the contributing drainage area. The trunk line of this system is undersized, with some pipes positioned on negative slopes. It appears that settling has occurred, resulting in sections of the systems being on a reverse gradient. The outfall ditch, in its existing condition, creates a tailwater effect which further reduces the capacity of this system.

16th Street and Kirby Street

The downstream end of the culvert under 16th Street is buried, thus inhibiting the conveyance of water. In addition, the piped system that outfalls to an existing ditch is inadequate for the 10-year design storm.

King William Avenue between Magnolia Drive and Pamunkey Avenue

The piped drainage system serving this area runs north along King William Avenue from Pamunkey Avenue and then turns east alongside the Jackson Hewitt Tax Service. This system's capacity is inadequate to serve the area draining to it. The system outfalls to an open ditch that is heavily vegetated at the point where the pipe ends. High tailwater conditions at the outfall may contribute to the inadequacy of this system during some rainfall events.

Elementary school adjacent to Chelsea Road

There are three areas around the West Point schools that are experiencing drainage problems. The gravel parking lot at the elementary school off of Chelsea Road, the grassed area adjacent to the high school along Mattaponi Avenue, and Thompson Avenue near the entrance of the high school do not drain adequately during most rainfall events.

There is no topographic relief in the gravel parking lot at the elementary school. Water drains from the surrounding area to a low spot located in the parking lot. Water stands in this location until it either evaporates or infiltrates. A dry well was recommended to expedite the infiltration process. The school has installed dry wells at two locations at the elementary school which have improved the drainage in this area.

Also, there is no topographic relief in the grassed area adjacent to the high school. An 18" culvert located under Mattaponi Avenue just northwest of this area has not been maintained and consequently does not provide any drainage from one side of the street to the other. The area north of the culvert has been designated as wetlands. A definite drainage pattern in this area cannot be determined from the existing topography as shown on the topographic maps.

The piped system draining the area near the entrance of the high school on Thompson Avenue is inadequate to carry the runoff from this area. The yard inlet on the south side of Thompson Avenue was full of water during several field visits, with no apparent positive drainage. Some of the downstream segments of this system, which outfall near Westwood Court, are positioned on adverse slopes.

5.0 RECOMMENDATIONS FOR CAPITAL IMPROVEMENTS PROGRAM

Water Quality Improvements

Based on the results of the water quality modeling, the Town should employ non-structural best management practices (BMP's) to manage the quality of stormwater runoff from future development. To provide a "no net increase" in phosphorus loadings to the receiving waters as prescribed by the Chesapeake Bay Local Assistance Department, land use management practices should be implemented. According to the water quality modeling (see Section 4.3), a "no net increase" in phosphorus loadings can be achieved within the Town if future development does not exceed 45% imperviousness in the Pamunkey River watershed or 34% imperviousness in the Mattaponi River watershed. Specific recommendations for changes in Town policies and ordinances are found in Section 6.0.

Although not recommended, structural BMP's were considered in the study. Wet ponds, dry ponds, and infiltration basins are structural measures accepted by CBLAD to "treat" stormwater runoff. The feasibility of locating a regional BMP facility within the Town was explored with the stormwater advisory committee. Two possible locations for regional facilities included the area just upstream of the Thompson Avenue crossing of West Point Creek and the vacant area north of 16th Street between Kirby and Main Streets. Based on several factors including wetland issues, permitting process, facility cost, and ongoing maintenance responsibilities, it was determined that a regional BMP would not be considered at this time.

Water Quantity Improvements

Criteria

According to VDOT guidelines, culverts serving secondary roads should be designed for a 5 - 10-year storm, while culverts serving primary roads should be designed for a 25-year storm. Storm sewer systems for primary and secondary roads should be designed for the 10-year storm for non-depressed roadways, and the 50-year storm for depressed roadways. Roadside and median ditches should have a 10-year storm capacity and a protective lining designed for the 2-year storm.

Culverts

Tables 5, 10, 15 and 20 list the existing capacities of selected culverts, and the expected peak flowrates under existing and future development for the 2-, 10-, 25-, and 100-year storms. As seen from these tables, there are several culverts that are inadequate to handle the peak flowrates from the VDOT-specified design storm.

Recommendation: Upgrade the secondary and primary road culverts to meet VDOT criteria.
Cost: Variable

Storm Sewer Systems

As mentioned in the previous section, five specific storm sewer systems were analyzed for drainage capacity. Where capacity was determined to be inadequate, conceptual designs for improvements were developed. These improvements and cost estimates are described below. See Appendix 4 for cost estimating worksheets.

7th and Main

To improve drainage in this area, an upgraded system is needed from the 7th Street/Main Street intersection down to the outfall. A system designed to handle the 10-year storm under developed conditions would increase in size from 12" at the beginning of the system to 30" at the outfall. Additional curb drop inlets would be needed along the route. Elliptical or parallel pipes may be needed to maintain minimum cover requirements. Estimated cost: $89,000

23rd and King William Avenue

A drainage system designed for the 10-year storm under developed conditions would consist of pipes ranging in size from 30" to 72", with additional drop inlets along the route. The length of the system and location of other existing utilities more than likely will require pipes at minimum slopes. The existing outfall ditch needs additional capacity to decrease tailwater effects. Several sections of pipe on the lower end of the system may need to elliptical or parallel. Estimated cost: $734,000

16th Street and Kirby Street

The piped system at this intersection needs to be upgraded to handle the flows from the 10-year design storm. The downstream end of the culvert under 16th Street is buried, blocking the flow through this pipe. Appropriate actions should be taken to ensure efficient flow through this culvert. Channel improvements are needed at the outfall ditch to maintain downstream capacity. Estimated cost: $11,000

King William Avenue between Magnolia Avenue and Pamunkey Avenue

A drainage system designed for the 10-year storm under developed conditions would consist of pipes ranging in size from 12" to 60", with additional drop inlets. The capacity of the existing outfall ditch would need to be increased to reduce high tailwater conditions. Estimated cost: $302,000

School area

Drainage improvements for Thompson Avenue at the elementary school would include placing curb and gutter and a new piped system along Thompson Avenue adjacent to the school to handle the 10-year design storm. Regrading of the areas adjacent to the right-of-way would be required. The new system would outfall to an existing channel east of the Thompson/Chelsea intersection. This improvement would also decrease the amount of area draining to the Westwood Court/Mattaponi Avenue intersection, which is currently undersized for the 10-year storm. This improvement only addresses the street flooding on Thompson Avenue. Estimated cost: $71,000

A new system to improve drainage along Mattaponi Avenue near the school, without disturbing the wetland area that has been created, would consist of a new piped system flowing south along Mattaponi Avenue from Bagby Street to Thompson Avenue and then east along Thompson Avenue to Chelsea Road. This system, ranging in pipe size from 12" to 54", would outfall to an existing channel east of Chelsea Road. Thompson Avenue and Mattaponi Avenue would need regrading and new curb and gutter. Regrading of the areas adjacent to the right-of-way would be required. The ditch flowing north to Bagby Street would require regrading and enlarging, and the culvert under Bagby Street would need upgrading. This improvement would also serve the existing problem area on Thompson Avenue at the elementary school. Estimated cost: $772,000

Additional problem areas where capital improvements for storm sewer systems are recommended include: the drainage system along Main Street from 11th Street to 14th Street and along 14th Street from Main Street to the outfalls, Mattaponi Avenue north of Bagby Street, and Bagby Street west of Mattaponi Avenue.

Tidal Water

Due to the low and flat topography of West Point, certain drainage systems in the Town are influenced by the tidal rise and fall of the Pamunkey, Mattaponi, and York Rivers. The capacity of the drainage systems at the lower elevations will vary depending on the tide levels. During high tide, there are some systems that are completely full of water from the rivers. For example, the rim elevations of the drop inlets at the 2nd Street/Kirby Street intersection are below high tide levels. Therefore, when it rains during high tide, the pipes in this system are already full of water and they do not have the capacity to handle the runoff. This situation occurs in other areas of the Town as well.

There are few feasible alternatives available to improve drainage in these situations. One choice is to pump the water from the low-lying areas, and the other is to block the tidal water from entering the low-lying areas by means of flood walls. Both of these alternatives are expensive to implement.

Another option is to abandon the flooded area if the flooding cannot be tolerated.

Drainage Easements

Drainage and maintenance easements should be obtained on all properties where runoff from public property drains. The cost of obtaining these easements depends upon the specific property to be obtained. The Town may be successful in negotiating with the property owners to obtain the land in exchange for regular maintenance of the system.

6.0 ORDINANCE/POLICY RECOMMENDATIONS

Comprehensive Land Use Plan

All of the water quantity and quality modeling performed in this study estimating future development conditions was based on land uses as designated in the Town's 1986 Comprehensive Land Use Plan. Results of this study are valid only for those specific land uses. Assumptions for average residential lot size used in the calculations include the following:

Low density residential	0.7 acre lots	18% impervious
Medium density residential	0.33 acre lots	25% impervious
High density residential	< 0.25 acre lots	35% impervious

We do not recommend any changes to the Comprehensive Land Use Plan; however, if significant land use changes are made to the plan, the results of the study will need to be reevaluated.

Chesapeake Bay Preservation Act

Existing average land cover conditions have been determined for the Town of West Point. As opposed to the default Chesapeake Bay watershed pollutant loading of 0.45 pounds/acre/year corresponding to an average percent imperviousness of 16%, specific values for the watersheds of West Point have been determined. It is recommended that two watersheds be specified within the Town, namely the Pamunkey River watershed and the Mattaponi River watershed as shown in Figure 13. Average land cover conditions for the Pamunkey River watershed result in a pollutant loading rate of 1.06 pounds/acre/year corresponding to an average percent imperviousness of 45%. Average land cover conditions for the Mattaponi River watershed produce a pollutant loading rate of 0.82 pounds/acre/year corresponding to an average percent imperviousness of 34%. These values should be adopted as baseline existing average land cover conditions for the Town's two major watersheds.

These existing average land cover conditions for the Town's two major watersheds were based upon existing land uses as depicted in the aerial photograph of the Town taken on April 12, 1993. Areas designated as undevelopable on Figure 13 represent potential Resource Protection Areas and were not considered in these calculations. Therefore, these areas should not be considered in site-specific calculations. These potential Resource Protection Areas were based upon the National Wetland Inventory Maps and were not field verified. Ground truthing of Resource Protection Areas on a specific site should be the responsibility of the individual developer.

Subdivision Ordinance

Recommended additions to the Town's Subdivision Ordinance include the following:

1. Drainage ditches should have a bottom slope greater than 0.25 percent.
2. Drainage ditches with less than one percent bottom slope should be paved with concrete

or other appropriate lining as accepted by the Town.

3. No road should be constructed with less than 0.4 percent gradient.

Erosion and Sediment Control

Based upon our field inspections, there does not appear to be a chronic erosion problem within the Town. Flat bottom slopes and heavily vegetated ditches reduce the velocity of water flowing through open channels, thereby reducing the erosive forces of the water.

No revisions to the Erosion and Sediment Control ordinance are recommended.

General Recommendations

1. Avoid running other utilities through the storm drainage system.
2. Drainage systems should be designed to handle runoff from the entire area draining to the system, assuming full development of the drainage area. If stormwater controls are required, the timing of the release and corresponding downstream impacts on peak flowrates should be considered.
3. Obtain drainage easements where appropriate.
4. Prohibit the obstruction of drainageways throughout the Town.

7.0 MAINTENANCE PROGRAM

In West Point and other incorporated towns with populations under 3,500, the Virginia Department of Transportation (VDOT) is responsible for maintaining drainage systems including roadside ditches, curb and gutter, drop inlets, and cross drains within the right of way. VDOT's policy states that they are not responsible for storm sewer outfalls or outlet ditches outside the right of way unless they are constructed by VDOT on easements required for that purpose.

The Town of West Point is served by the Bowling Green Residency Office of VDOT. This office has no record of VDOT easements within West Point; therefore, their maintenance responsibilities are limited to systems within the right of way. The Town has the responsibility of maintaining those portions of the drainage system on public property beyond the right of way and within established drainage easements. However, much of the Town's drainage system is located on private property where no drainage easements exist.

For various reasons, the drainage system in West Point has not been regularly maintained. The lack of maintenance has contributed to drainage problems experienced within the Town. Cases of buried outfalls, clogged inlets, overgrown ditches, and debris-filled pipes were discovered during field investigations. Several factors have contributed to the lack of regular maintenance of the drainage system either within or outside the right of way in West Point. Some of these factors include the following:

* VDOT does not have the resources necessary to implement a regular maintenance program for the localities that they serve.
* No maintenance program has been established for the Town.
* Most of the maintenance that does take place is in reaction to a problem as opposed to regularly scheduled activities.
* Much of the drainage system is located on private property.

A successful stormwater management program will only be realized with an effective maintenance program. A maintenance program will include strategic scheduling of activities such as inlet cleaning, ditch maintenance, pipe cleaning, and sediment clean out. These activities will allow drainage systems to perform to their potential, while also providing water quality benefits.

Recommendations

1. Obtain drainage easements on private property where drainage systems serve runoff from public property.
2. Clean storm pipes annually.
3. Clean inlets after significant rainfall events.

4. Clean ditches every year. Cut grass-lined channels at least once per month during the growing season.

5. Inspect outfalls/culverts on a regular basis. Clean/repair as necessary.

6. Develop a GIS-based maintenance schedule.

7. Bring manholes/structures to grade.

8. Repair joints/cracks in drainage pipes/structures.

It is understood that many of these maintenance tasks are the responsibility of VDOT. Unless the Town receives adequate funding from the State to take on VDOT's responsibilities, VDOT should remain responsible for maintaining the drainage systems within the right-of-way.

According to sources at the Bowling Green Residency Office, VDOT's drainage maintenance costs in West Point approached $30,000 for the July, 1992 through June, 1993 fiscal year. The breakdown of costs is as follows:

Maintenance of primary road systems	$ 14,770
Maintenance of secondary road systems	11,355
Maintaining ditches by hand	2,170
Maintaining ditches by machine	1,565
Total	$ 29,860

The Town currently has no set budget for maintaining the drainage system outside the right-of-way. Historically the Town reacts to a problem when it occurs, but no regular maintenance schedule is followed. A reliable funding source should be established to ensure that regular maintenance activities are implemented.

8.0 FINANCING MECHANISMS

Stormwater runoff has long been recognized as a major cause of water quality degradation. In response, the Commonwealth of Virginia will be developing strategies to reduce excess nutrients that enter the James, York and Rappahannock rivers as part of the Chesapeake Bay Program. These "tributary" strategies will deal with the excess amounts of nutrients entering the rivers from both point and non-point sources. The overall goal is to reduce nutrients currently entering the Bay by 40%. Stormwater management at the local level will play a major role.

Since stormwater management programs such as ones mandated by the Chesapeake Bay Preservation Act are relatively new, most localities have not yet developed comprehensive programs to plan, develop, maintain and finance such programs. Nevertheless, it is clear that in order to meet existing regulatory requirements along with future nutrient reduction goals, expenditures for stormwater management at the local level must increase.

Traditionally stormwater management or "drainage projects" have been financed through property taxes. Recently, some grant funding has been made available to localities to prepare stormwater management plans. However, neither property taxes nor grants alone can be expected to adequately provide the funds necessary to administer stormwater management programs including such elements as planning and engineering, property acquisition, operation and maintenance, remediation, and site plan review over the long-term. Since stormwater management costs are anticipated to increase, budget allocations are not likely to keep pace unless additional revenue sources can be identified.

In a survey performed by the Hampton Roads Planning District Commission, local expenditures for stormwater management-related activities increased 16% to 38% between 1984 and 1989. (It should be noted that these increased expenditures occurred before localities began implementing the programmatic requirements of the Chesapeake Bay Preservation Act.) The survey also found that all the surveyed localities relied heavily upon general fund revenues and Capital Improvement Programs. Some localities also used general obligation bonds, Community Development Block Grants and cost share agreements with developers.

Like most localities, the Town of West Point has relied on the general fund and grants to finance stormwater management. In addition to funding from the operating budget, the Town appropriated $100,000 in the FY 92-93 Capital Improvements Budget for the Master Storm Water Study and received a $30,000 grant from the Commonwealth of Virginia for stormwater management planning. However, no capital improvement funds for stormwater related projects have been allocated for FY 93-94 and beyond. Grant funds are generally awarded on an annual basis and are competitive in nature; therefore, they are not viable as a reliable long-term revenue source for administering a comprehensive stormwater management program.

Since the operating budget cannot be expected to bear the entire burden of stormwater remediation needs identified in this report or administer a stormwater management system addressing future growth, other options must be considered. Those include:

- General Obligation Bonds
- Revenue Bonds
- Land Development Fees
- Participation Agreements
- Special Service Districts
- Stormwater Utility

8.1 GENERAL OBLIGATION BONDS

General obligation bonds are long-term borrowing mechanisms which are commonly sold by local governments to finance major non-revenue producing capital improvements such as roads, schools, and recreational facilities. These bonds have traditionally been used as a means of financing stormwater management projects. The taxing power of a locality is pledged through the general fund or other local sources to pay interest and retire debt on bond issues.

The advantages of general obligation bonds include low interest rates, ability to finance both the short and long-term stormwater management program costs, and these bonds can be issued in a relatively short timeframe.

However, localities are subject to specific debt restrictions under the Code of Virginia. A locality's outstanding debt obligation is limited to no more than ten percent of the assessed value of taxable real estate.

A disadvantage of general obligation bonds is that bond installments paid from the general fund over a long period of time may reduce the Town's ability to fund other programs that are not supported by obligated funds. Interest rates also may fluctuate.

8.2 REVENUE BONDS

Revenue bonds are usually associated with water and sewer projects. Revenues from such projects are used to pay annual dividends to bond holders. Debt is retired from the revenues produced by a particular enterprise rather than from the general fund. A prime advantage of revenue bonds is that, because they are not backed by the full faith and credit of the Town, bonding capacity is not reduced. A disadvantage is that interest rates for revenue bonds are higher than general obligation bonds and are, therefore, more expensive to issue. Also, a stormwater utility must be established to serve as the revenue generator if the bond funds are used for stormwater management projects.

Nevertheless, revenue bonds together with a stormwater utility may represent a very viable financing strategy for West Point.

8.3 LAND DEVELOPMENT FEES

Pursuant to Section 15.1-466(d) of the Code of Virginia, localities are required to provide adequate drainage and flood control. Section 15.1-466(j) enables localities to assess fees to developers based on the pro-rata share of runoff contributed by development. However, the Town must have a comprehensive stormwater management plan in place. Also, fees can only be used for off-site facilities serving the developer's project. These fees are usually assessed on a per acre basis, based on imperviousness, land use or contribution to peak flow. Credits may be given if on-site control is provided. This option is especially attractive where regional systems are contemplated.

Under the Chesapeake Bay Preservation Act regulations, the Town may implement this alternative in lieu of a program which requires on-site controls. On-site control programs are generally less effective and are more difficult to administer than regional systems.

A number of disadvantages to this option include:

- Fees can only be assessed on new development. Costs cannot be recovered from existing developers in the watershed.
- Fees can only be used for the construction of facilities that serve new development.
- Facilities must be constructed in advance of development and before receipt of fees.
- Since fees can only be used to construct regional stormwater management facilities, the availability of suitably sized tracts of undeveloped land within the Town limits becomes an issue.
- Since approximately 40% of the Town's land area has established uses, and the rate of new growth has slowed, the opportunity to utilize this option is somewhat limited.
- Long term maintenance obligations would be incurred without a commensurate source of funds identified.

8.4 PARTICIPATION AND REIMBURSEMENT AGREEMENTS

This technique would involve agreement by a developer to finance and construct a regional stormwater management facility to the specifications of the Town and then be reimbursed over time as new development occurs in the same watershed. The benefit of this approach is that the Town does not have to provide the up-front capital to construct a facility.

However, given the relatively slow rate of undeveloped land conversion within the Town, the rate of reimbursement may not be attractive to potential developers.

8.5 SPECIAL SERVICE DISTRICTS

Special service stormwater management districts can be established in designated watersheds. Property owners in such districts would be taxed by the Town to provide funds for the construction and maintenance of stormwater management facilities.

The establishment of a special stormwater management district may be difficult since its formation is contingent upon the approval of fifty percent of the proposed district's voters. Consequently, this alternative is probably only viable in developed areas of the Town where chronic flooding problems are so severe that residents are willing to tax themselves to obtain relief. It is unlikely that residents of a sparsely developed watershed without existing drainage problems would create a district in anticipation of future development.

8.6 STORMWATER UTILITY

Establishment of a stormwater utility is an attractive option for the financing of stormwater management in West Point. Many localities throughout the United States are using stormwater utilities in combination with bonds and other programs to finance all aspects of local stormwater management. In Virginia, several localities in Hampton Roads, including the Cities of Norfolk, Chesapeake and Virginia Beach, have created stormwater utilities.

A stormwater utility is similar to a water and sewer utility in that it is a local government enterprise, financially separate from other municipal functions, and it is financed by user fees placed into restricted accounts that can be used only for stormwater management purposes. The main advantage of a stormwater utility is that revenues can be generated without impacting the Town's operating budget. These revenues also can be used to support the issue of revenue bonds.

Nationwide, the emergence of stormwater utilities is a relatively new phenomenon. Although some localities, such as Boulder, Colorado, have stormwater utilities dating back to 1973, most were authorized during or after the mid-1980's, largely following the recognition that traditional revenue sources at the local level were not keeping pace with the costs of mandated stormwater management related programs. This was especially evident in the area of maintenance. Stormwater management facilities were not performing as effectively as possible due to lack of proper maintenance. Proper maintenance was not being performed due to lack of funds.

In Virginia, no stormwater utilities existed prior to 1991. This was due to the fact that no clear authorization under Virginia law enabled localities to establish such utilities. In 1991, the Virginia General Assembly passed legislation authorizing every county, city or town in the Commonwealth to adopt a "stormwater control program" by "establishing a utility or enacting a system of service charges."

Pursuant to Code of Virginia Section 15.1-292.4, the local governing body of any locality which administers a stormwater control program may recover related costs through the establishment of a utility. All revenues so derived, however, are considered "dedicated special revenue" and can only be used for certain purposes. Those are:

1. Acquisition of real and personal property necessary to construct, operate and maintain stormwater control facilities.

2. Administrative costs.

3. Engineering and design, debt retirement, construction costs for new facilities and improvement of existing facilities.

4. Facility maintenance.

5. Monitoring of stormwater control devices.

6. Pollution control and abatement, consistent with State and Federal regulations for water pollution control and abatement.

This legislation also authorizes localities to issue general obligation bonds or revenue bonds in order to finance infrastructure costs.

Two or more localities may also enter into cooperative agreements for the management of stormwater.

Stormwater utilities should assess fees to all generators of runoff located in areas where runoff is conveyed through the town system. Stormwater utility fees should be related to the amount of runoff generated over and above that of a given parcel in the natural condition. In some instances, credits for on-site runoff control are allowed. The following briefly describes three techniques for assessing stormwater utility fees.

- The "rational method" bases the fee on runoff coefficients associated with different land uses.

- A fee based on the amount of impervious surface on a given lot or parcel.

- A flat, uniform charge assessed to each property owner.

8.7 REVENUE ESTIMATES

In order to determine an "order of magnitude" estimate of the potential annual revenue contribution of a stormwater utility to the Town of West Point, the "rational method" was adapted to existing land uses. The following assumptions were used;

- An "Equivalent Residential Unit" (ERU) was the base unit adjusted for land use. One acre of residential use represented approximately 3,000 square feet of impervious surface.

- All residences, regardless of lot size, would be assessed a monthly charge based on one ERU.

- Commercial uses would be assessed based upon an impervious surfaces percentage of 50 - 70% per acre or 6 ERUs per acre.

- Industrial uses would be assessed based upon on impervious surfaces percentage of 70 - 90% per acre or 8 ERUs per acre.

- Institutional, agricultural and undeveloped properties would be exempt.

- 1993 land use data.

- All developed property within the Town limits would be assessed regardless of drainage pattern.

HYPOTHETICAL ANNUAL REVENUE YIELD
WEST POINT STORMWATER UTILITY

TOTAL LAND AREA = 3,133 ACRES

LAND USE	(DWELLINGS) ACREAGE	PERCENT IMPERVIOUS SURFACES	ERU/ ACRE	ANNUAL REVENUE	
				LOW	HIGH
RESIDENTIAL	(1099) 659	10%	1	$23,079	$39,564
COMMERCIAL	96	50%-70%	6	$12,096	$20,736
INDUSTRIAL	193	70%-90%	8	$32,256	$55,296
AGRICULTURAL	294	N/A	0	0	0
INSTITUTIONAL	51	N/A	0	0	0
UNDEVELOPED	1,840	N/A	0	0	0
TOTAL	3,133			$67,431	$115,596

Rate: Low = $1.75/month/ERU
High = $3.00/month/ERU

Recommendations

Clearly, the Town of West Point must develop a comprehensive approach to the financing of stormwater management. The traditional approach which has relied heavily upon the operating budget, capital improvement budget and occasional grant funding will not provide revenues in an amount sufficient to correct existing drainage problems or offset long-term costs associated with administering new programs such as mandated by the Chesapeake Bay Preservation Act.

A comprehensive approach consisting of traditional approaches augmented by the creation of a stormwater utility and periodic issuance of revenue bonds holds the greatest promise to provide a stable, equitable, long-term source of revenue to meet these difficult challenges.

Specifically, the following recommended actions are offered.

The Town should:

1. Conduct an audit to determine the level of current expenditures devoted to stormwater management. This would include all costs associated with planning and administration, engineering, site plan review, operations and maintenance, inspection and enforcement, capital expenditures, etc.

2. Conduct an analysis of the anticipated costs associated with mandated programs compliance. This should include the future cost of ordinance development and administration, comprehensive plan amendments, enhanced site plan review, stormwater master plan preparation and administration, and operation and maintenance of facilities.

3. Adopt a Stormwater Control Program or its equivalent in accordance with Section 15.1-292.4 of the Code of Virginia.

4. Conduct a detailed cost/effectiveness analysis including draft ordinance preparation to determine the feasibility and anticipated public acceptance of a Stormwater Utility.

REFERENCES

1. Virginia Department of Environmental Quality.
Discussion Paper: Reducing Nutrients in Virginia's Tidal Tributaries. May 1993.

2. Hampton Roads Planning District Commission.
Stormwater Management Financing Strategy for Hampton Roads Virginia. February 1991.

3. Maryland Department of the Environment.
A Survey of Stormwater Utilities. March 1988.

4. Maryland Department of the Environment.
Financing Stormwater Management: The Utility Approach. August 1988.

5. Maryland Department of the Environment.
Potential Revenues from Stormwater Utilities in Maryland. July 1991.

6. Town of West Point. Operating Budget. FY 92-93.

7. Town of West Point. Capital Improvements Budget. 7/1/92 - 6/30/97.

8. Town of West Point. A Comprehensive Plan. September, 1986.

APPENDIX 1
CHANNEL INFORMATION

CHANNEL INFORMATION

MAP ID	LOCATION	HEC-1 ID	TYPICAL CROSS-SECTION (DIMENSIONS IN FEET)	ESTIMATED ROUGHNESS	TOPOGRAPHIC MAP SHEET #
1	Channel flowing east to Magnolia Ave.	S11	TRAPEZOIDAL B=3.5 T=7.0 D=1.6	0.05	17
2	Swale flowing south to 1	n/a	TRAPEZOIDAL B=2.5 T=6.5 D=1.1	0.05	17
3	Swale flowing south to 2	n/a	TRAPEZOIDAL B=2.0 T=4.5 D=1.9	0.05	21
4	Confluence in sub-basin C-11	n/a	TRAPEZOIDAL Upstream B=2.0 T=7.0 D=0.5	0.045	17
			Downstream B=4.0 T=7.0 D=0.9	0.045	
5	Swale flowing east under old RR	n/a	TRAPEZOIDAL Upstream B=3.0 T=6.0 D=1.5	0.045	17
			Downstream B=5.0 T=8.0 D=1.3	0.045	

6	Channel flowing east to Magnolia in C-9	n/a	TRAPEZOIDAL B=6.0 T-10.0 D=1.0	0.055	17
7	Confluence south of Magnolia in C-13	U/S East=S10 U/S West=S9 D/S n/a	TRAPEZOIDAL Upstream East B=4.0 T=8.0 D=1.0	0.045	17
			Upstream West B=3.0 T=6.0 D=0.6	0.045	
			Downstream B=5.0 T=7.0 D=1.4	0.045	
8	Confluence in sub-basin C-12	n/a	TRAPEZOIDAL Upstream East B=5.0 T=8.0 D=1.3	0.065	21
			Upstream West B=6.0 T=9.0 D=1.2	0.065	
			Downstream South B=6.0 T=9.0 D=1.1	0.065	
9	Confluence of C-13, C-15, and C-14	n/a	NO DEFINED CHANNELS B=3.0 D=0.2	0.05	18
10	Confluence in C-13	U/S North=S12	TRAPEZOIDAL		18

	upstream of (9)		Upstream North B=0 T=9.0 D=1.0	0.05	
			NO DEFINED CHANNELS Upstream South, Downstream		
11	Confluence of C-14, C-7, and C-6	S14, S7, S6	NO DEFINED CHANNELS Upstream North (S14) B=4.0 D=0.25	0.065	13
			Upstream South (S7) B=3.5 D=0.15	0.065	
			Downstream (S6) B=5.0 D=0.3	0.065	
12	Channel flowing west to West Pt. Creek	S16	TRAPEZOIDAL B=4.0 T=5.0 D=0.5	0.065	13
13	Channel in C-25 flowing south	n/a	NO DEFINED CHANNEL	0.08	14
14	Channel flowing south in C-26	n/a	TRAPEZOIDAL B=3.0 T=5.0 D=1.2	0.09	14
16	Confluence in C-21	S21	TRAPEZOIDAL Upstream West B=3.5 T=6.0 D=1.5	0.045	14

			Upstream East B=1.5 T=4.0 D=2.0 Upstream South B=3.0 T=5.0 D=2.0 U-SHAPED Downstream T=5.0 D=1.0		
17	Channel in C-21	n/a	NO DEFINED CHANNEL Upstream West, Downstream TRAPEZOIDAL Upstream East B=3.0 T=3.0 D=1.5	0.06	9
19	Confluence at C-24, C-25, and C-23	n/a	TRAPEZOIDAL Upstream West, East B=4.0 T=6.0 D=1.5 Downstream B=6.0 T=8.0 D=2.0	0.055	14
20	Confluence at C-26, C-23, and C-20	D/S=S20	TRAPEZOIDAL Upstream West B=3.0 T=4.0 D=3.0		9

		U/S East=S23	Upstream East B=4.0 T=6.0 D=2.0	0.055	
			Downstream B=5.5 T=6.0 D=3.5	0.06	
21	Magnolia Ave. Tributary @ Chelsea Rd.	S285	MARSH	0.05	22
22	Channel flowing north to (21)	D/S=S28	TRAPEZOIDAL Downstream B=2.5 T=4.0 D=3.5	0.065	22
			Upstream B=4.5 T=5 D=0.75		
23	Confluence at C-29 and C-31	D/S=S31	* U-SHAPED Upstream north B=1.5 D=1.0		22
			TRAPEZOIDAL Upstream south B=4.0 T=5.0 D=1.0	0.06	
			Downstream B=2.0 T=5.0 D=4.5	0.05	

24	North Chelsea Tributary	S32	MARSH		0.04	25

APPENDIX 2
HEC-1 PRINTOUTS

HEC1 S/N: 1343000043   HMVersion: 6.33   Data File: C:\WESTPT\WP2EXIN.PRN

```
****************************************                                         ****************************************
*                                      *                                         *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                         *  U.S. ARMY CORPS OF ENGINEERS        *
*              MAY   1991              *                                         *  HYDROLOGIC ENGINEERING CENTER       *
*           VERSION 4.0.1E             *                                         *        609 SECOND STREET             *
*                                      *                                         *     DAVIS, CALIFORNIA 95616          *
*  RUN DATE  08/19/1993  TIME  10:33:36 *                                        *          (916) 756-1104              *
*                                      *                                         *                                      *
****************************************                                         ****************************************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X       XXXXX    X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

```
:::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::
:::                                     :::
:::  Full Microcomputer Implementation  :::
:::                 by                  :::
:::         Haestad Methods, Inc.       :::
:::                                     :::
:::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID    WEST POINT CREEK     EXISTING CONDITIONS
  2           ID    L&M JOB 92-093       2-YEAR STORM
              *DIAGRAM
  3           IT       5                     288
  4           IO       5
              *
              *

  5           KK     C11
  6           BA   0.168
              * 2-YEAR STORM      VDOT
              *                   0.47    0.95     1.6    2.06    2.28    2.52    2.76    2.88
              * 2-YEAR STORM       NWS
  7           PH                    0.47    0.95     1.6    1.81    2.02    2.55    3.03     3.5
              * 10-YEAR STORM     VDOT
              *                    0.6    1.28     2.3    2.96    3.27     3.6    3.96    4.08
              * 10-YEAR STORM      NWS
              *                    0.6    1.28    2.28    2.61    2.95     3.8    4.56    5.33
              * 25-YEAR STORM     VDOT
              *                   0.68    1.49    2.71     3.5    3.87    4.38    4.56     4.8
              * 25-YEAR STORM      NWS
              *                   0.68    1.49    2.68    3.08    3.49    4.53    5.45    6.38
              * 100-YEAR STORM    VDOT
              *                   0.81    1.81    3.35    4.32    4.77    5.16    5.64    5.76
              * 100-YEAR STORM     NWS
              *                   0.81    1.81     3.3    3.82    4.33    5.65    6.83       8
  8           LS               67
  9           UD   1.578

 10           KK     S11
 11           RS       3    FLOW      -1
 12           RC    0.07    0.05    0.07    1400   0.003
 13           RX     175     240   271.5  273.25  276.76   278.5     320     410
 14           RY      16      14    13.5    11.9    11.9    13.5      14    16.1

 15           KK     C10
 16           BA     0.1
 17           LS               70
 18           UD    1.38

 19           KK   J@MAG   COMBINE S11 AND C10
 20           HC       2
              *    MAG   CULVERT AT MAGNOLIA
              *      1    ELEV       ?
              *
              *
              *

 21           KK     S10
 22           RS            FLOW      -1
 23           RC   0.085   0.045   0.085     440   0.003
 24           RX       0      80     127   128.5   131.5     133     270     400
 25           RY      14      12   10.07    9.33    9.33   10.07      12      14
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 26           KK      C9
 27           BA    0.06
 28           LS                72
 29           UD   0.846
              *   MAGW   CULVERT AT MAGNOLIA-WEST
              *      1    ELEV        ?
              *
              *
              *

 30           KK      S9
 31           RS       4    FLOW      -1
 32           RC   0.085   0.045   0.085    1050   0.003
 33           RX       0      80     127   128.5   131.5     133     270     400
 34           RY      14      12   10.07    9.47    9.47   10.07      12      14

 35           KK     C12
 36           BA   0.095
 37           LS                69
 38           UD   2.592
              *   MAGE   CULVERT AT MAGNOLIA-EAST
              *      1    ELEV        ?
              *
              *
              *

 39           KK     S12
 40           RS       7    FLOW      -1
 41           RC   0.085    0.05   0.085    1000  0.0008
 42           RX     100     160   165.5     170   174.5     180     270     360
 43           RY      10       8     7.9    6.88     7.9       8       9      10

 44           KK   J@C13 COMBINE S9, S10, AND S12
 45           HC       3

 46           KK     C13
 47           BA   0.062
 48           LS                65
 49           UD   1.056

 50           KK     C15
 51           BA   0.066
 52           LS                74
 53           UD   1.176

 54           KK   J@S14   COMBINE J@C13, C13, AND C15
 55           HC       3

 56           KK     S14
 57           RS      18    FLOW      -1
 58           RC   0.105   0.065   0.105    1550  0.0012
 59           RX     210     230     280     285     289     295     410     420
 60           RY       8       6       4    3.75    3.75       4       6       8
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 61           KK     C14
 62           BA   0.045
 63           LS                 64
 64           UD   1.164

 65           KK      C7
 66           BA   0.084
 67           LS                 73
 68           UD    1.26

 69           KK      C8
 70           BA   0.131
 71           LS                 75
 72           UD   0.912

 73           KK      S7
 74           RS      10    FLOW      -1
 75           RC   0.105   0.065   0.105    1450  0.0032
 76           RX     150     170     185     223     227     255     275     310
 77           RY      12      10       8    6.15    6.15       8      10      12

 78           KK    J@S6   COMBINE C14, S14, C7, AND S7
 79           HC       4

 80           KK      S6
 81           RS      20    FLOW      -1
 82           RC   0.105   0.065   0.105    1900  0.0011
 83           RX     230     330     335     387     392     435     440     510
 84           RY       8       2     1.9     1.7     1.7     1.9       2       8

 85           KK      C6
 86           BA   0.083
 87           LS                 68
 88           UD   1.128

 89           KK     C16
 90           BA    0.05
 91           LS                 77
 92           UD   0.786
              *  ODI-N   CULVERT AT ODI-NORTH
              *       1    ELEV       ?
              *
              *
              *

 93           KK     S16
 94           RS       2    FLOW      -1
 95           RC   0.105   0.065   0.105     450  0.0125
 96           RX     155     180   197.5     198     202   202.5     215     265
 97           RY       8       4    2.54    2.49    2.49    2.54       4       8
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  98          KK     C17
  99          BA   0.021
 100          LS              70
 101          UD   0.576
              *  ODI-S   CULVERT AT ODI-SOUTH
              *     1    ELEV       ?
              *
              *
              *

 102          KK     S17
 103          RS       2    FLOW      -1
 104          RC    0.03    0.03    0.03     660    0.01
 105          RX       0     180     260     264     266     268     280     320
 106          RY     9.9       8     6.5       5       5     6.5       7       8

 107          KK  J@TWEST  COMBINE C6, S6, S16, S17
 108          HC       4

 109          KK   TWEST   CULVERT AT THOMPSON-WEST
 110          RS       1    ELEV       3
 111          SA    4.82    7.54     9.3    9.37    9.56    9.87   10.31   10.89   12.54   14.73
 112          SA   17.29   20.18   30.73   31.35   32.92   34.33   35.43
 113          SE     1.8       2       3    3.04    3.15    3.33    3.58    3.91    4.32    4.79
 114          SE    5.34    5.96    6.66     6.7     6.8    6.89    6.96
 115          SQ       0       0       0      25      50      75     100     125     150     175
 116          SQ     200     225     250     350     400     450     500

 117          KK      S5
 118          RS       4    FLOW      -1
 119          RC    0.06    0.04    0.06    1700  0.0005
 120          RX     110     145     150     155     340     345     350     365
 121          RY       6       4       2     1.5     1.5       2       4       6

 122          KK     C18
 123          BA   0.034
 124          LS              67
 125          UD   1.122

 126          KK      C5
 127          BA   0.052
 128          LS              68
 129          UD   0.768

 130          KK     C19
 131          BA   0.042
 132          LS              76
 133          UD   2.022
              *  TEAST   CULVERT AT THOMPSON-EAST
              *     1    ELEV       ?
              *
              *
              *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 134          KK     S18
 135          RS       6    FLOW      -1
 136          RC    0.07   0.065    0.07    2300  0.0067
 137          RX     200     215     230     240     270     285     295     305
 138          RY       8       6       4       2       2       4       6       8

 139          KK    J@S4   COMBINE C18, C5, S5, AND S18
 140          HC       4

 141          KK      S4
 142          RS       7    FLOW      -1
 143          RC    0.06    0.04    0.06    2800  0.0005
 144          RX      68      78      88     170     320     330     340     380
 145          RY       8       6       4       2       2       4       6       8

 146          KK      C4
 147          BA   0.074
 148          LS              66
 149          UD    0.93

 150          KK    J@S3   COMBINE S4 AND C4
 151          HC       2

 152          KK      S3
 153          RS       9    FLOW      -1
 154          RC    0.06    0.04    0.06    3700  0.0005
 155          RX     110     125     155     178     325     335     347     357
 156          RY       8       6       4       2       2       4       6       8

 157          KK     C24
 158          BA   0.036
 159          LS              76
 160          UD   1.344

 161          KK     C25
 162          BA   0.031
 163          LS              76
 164          UD   1.494

 165          KK   J@S23   COMBINE C24 AND C25
 166          HC       2

 167          KK     S23
 168          RS       5    FLOW      -1
 169          RC   0.095   0.055   0.095    1600  0.0008
 170          RX       0      10      50      51      55      56     356     656
 171          RY     5.8     5.8     4.8     2.8     2.8     4.8     4.9       5

 172          KK     C26
 173          BA   0.068
 174          LS              77
 175          UD   1.542
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 176          KK     C23
 177          BA    0.03
 178          LS              75
 179          UD   1.242

 180          KK   J@S20   COMBINE C23, C26, AND S23
 181          HC       3

 182          KK     S20
 183          RS      10    FLOW      -1
 184          RC   0.065    0.06   0.065    2000  0.0004
 185          RX       0      50     250  250.25  255.75     256     386     406
 186          RY     7.2     6.2       6     2.5     2.5       6     6.2     7.2

 187          KK     C20
 188          BA   0.032
 189          LS              73
 190          UD   0.792

 191          KK      C3
 192          BA   0.095
 193          LS              71
 194          UD    1.58

 195          KK     C22
 196          BA   0.035
 197          LS              79
 198          UD   0.702
              *    OAK   CULVERT AT OAK LANE
              *      1     ELEV      ?
              *
              *
              *

 199          KK     S21
 200          RS      16    FLOW      -1
 201          RC   0.065   0.045   0.065    3800  0.0006
 202          RX       0      70      90     150     220     240     315     390
 203          RY    10.5    11.5      10       8       8      10    10.4    10.8

 204          KK     C21
 205          BA   0.107
 206          LS              69
 207          UD   1.134

 208          KK  J@S20A   COMBINE S21 AND C21
 209          HC       2

 210          KK    S20A
 211          RS       2    FLOW      -1
 212          RC   0.065    0.06   0.065     400  0.0004
 213          RX      40      46      55      65      85      95     125     150
 214          RY       8       6       4       2       0       0       2       4
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 215          KK    J@S2   COMBINE S20A, C3, S20, C20, AND S3
 216          HC       5

 217          KK      S2
 218          RS       4    FLOW      -1
 219          RC    0.06    0.04    0.06    1750  0.0005
 220          RX      50      90     110     150     310     340     380     390
 221          RY       8       6       4       2       2       4       6       8

 222          KK      C2
 223          BA   0.067
 224          LS              75
 225          UD    0.54

 226          KK   J@R14   COMBINE C2 AND S2
 227          HC       2
              *    R14   CULVERT AT 14TH STREET
              *      1    ELEV       ?
              *
              *
              *

 228          KK      S1
 229          RS       4    FLOW      -1
 230          RC    0.06    0.04    0.06    1800  0.0005
 231          RX       0     0.1      50      82     132     139     146     186
 232          RY       5       5       4       2       2       4       6       8

 233          KK      C1
 234          BA   0.078
 235          LS              83
 236          UD    0.39

 237          KK   J@MAT COMBINE S1 AND C1
 238          HC       2
 239          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   5        C11
              V
              V
  10        S11
              .
              .
  15          .          C10
              .            .
              .            .
  19      J@MAG.............
              V
              V
  21        S10
              .
              .
  26          .           C9
              .            V
              .            V
  30          .           S9
              .            .
              .            .
  35          .            .          C12
              .            .            V
              .            .            V
  39          .            .          S12
              .            .            .
              .            .            .
  44      J@C13.......................
              .
              .
  46          .          C13
              .            .
              .            .
  50          .            .          C15
              .            .            .
              .            .            .
  54      J@S14.......................
              V
              V
  56        S14
              .
              .
  61          .          C14
              .            .
              .            .
  65          .            .           C7
              .            .            .
              .            .            .
  69          .            .            .           C8
              .            .            .            V
              .            .            .            V
  73          .            .            .           S7
              .            .            .            .
              .            .            .            .
  78       J@S6...................................
              V
              ..
```

```
80           S6
              .
              .
85            .          C6
              .           .
              .           .
89            .           .         C16
              .           .           V
              .           .           V
93            .           .         S16
              .           .           .
              .           .           .
98            .           .           .         C17
              .           .           .           V
              .           .           .           V
102           .           .           .         S17
              .           .           .           .
              .           .           .           .
107      J@TWES....................................
              V
              V
109       TWEST
              V
              V
117          S5
              .
              .
122           .         C18
              .           .
              .           .
126           .           .          C5
              .           .           .
              .           .           .
130           .           .           .         C19
              .           .           .           V
              .           .           .           V
134           .           .           .         S18
              .           .           .           .
              .           .           .           .
139        J@S4....................................
              V
              V
141          S4
              .
              .
146           .          C4
              .           .
              .           .
150        J@S3............
              V
              V
152          S3
              .
              .
157           .         C24
              .           .
              .           .
161           .           .         C25
              .           .           .
              .           .           .
165           .       J@S23............
              .           V
              .           V
167           .         S23
              .           .
```

```
              .           .
172           .           .         C26
              .           .           .
              .           .           .
176           .           .           .         C23
              .           .           .           .
              .           .           .           .
180           .       J@S20........................
              .           V
              .           V
182           .         S20
              .           .
              .           .
187           .           .         C20
              .           .           .
              .           .           .
191           .           .           .          C3
              .           .           .           .
              .           .           .           .
195           .           .           .           .         C22
              .           .           .           .           V
              .           .           .           .           V
199           .           .           .           .         S21
              .           .           .           .           .
              .           .           .           .           .
204           .           .           .           .           .         C21
              .           .           .           .           .           .
              .           .           .           .           .           .
208           .           .           .           .      J@S20A............
              .           .           .           .           V
              .           .           .           .           V
210           .           .           .           .        S20A
              .           .           .           .           .
              .           .           .           .           .
215        J@S2................................................
              V
              V
217          S2
              .
              .
222           .          C2
              .           .
              .           .
226       J@R14............
              V
              V
228          S1
              .
              .
233           .          C1
              .           .
              .           .
237       J@MAT............
(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

HEC1 S/N: 1343000043   HMVersion: 6.33   Data File: C:\WESTPT\WP2EXIN.PRN

```
*****************************************                                                           ****************************************
*                                       *                                                           *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                           *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY   1991               *                                                           *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E              *                                                           *         609 SECOND STREET            *
*                                       *                                                           *     DAVIS, CALIFORNIA 95616          *
* RUN DATE  08/19/1993  TIME  10:33:36  *                                                           *          (916) 756-1104              *
*                                       *                                                           *                                      *
*****************************************                                                           ****************************************
```

```
                          WEST POINT CREEK     EXISTING CONDITIONS
                          L&M JOB 92-093       2-YEAR STORM

  4 IO         OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT         HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1   0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      1   0  ENDING DATE
                   NDTIME       2355  ENDING TIME
                   ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   23.92 HOURS

       ENGLISH UNITS
            DRAINAGE AREA          SQUARE MILES
            PRECIPITATION DEPTH    INCHES
            LENGTH, ELEVATION      FEET
            FLOW                   CUBIC FEET PER SECOND
            STORAGE VOLUME         ACRE-FEET
            SURFACE AREA           ACRES
            TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C11	21.	13.83	12.	4.	4.	0.17		
ROUTED TO	S11	20.	14.25	12.	4.	4.	0.17	13.73	14.25
HYDROGRAPH AT	C10	17.	13.50	9.	3.	3.	0.10		
2 COMBINED AT	J@MAG	35.	13.83	20.	6.	6.	0.27		
ROUTED TO	S10	35.	14.00	20.	6.	6.	0.27	10.88	14.00
HYDROGRAPH AT	C9	17.	12.92	6.	2.	2.	0.06		
ROUTED TO	S9	16.	13.33	6.	2.	2.	0.06	10.60	13.33
HYDROGRAPH AT	C12	10.	15.08	7.	2.	2.	0.09		
ROUTED TO	S12	10.	15.75	7.	2.	2.	0.09	8.37	15.75
3 COMBINED AT	J@C13	50.	13.67	32.	10.	10.	0.42		
HYDROGRAPH AT	C13	9.	13.17	4.	1.	1.	0.06		
HYDROGRAPH AT	C15	17.	13.25	7.	2.	2.	0.07		
3 COMBINED AT	J@S14	73.	13.50	43.	14.	14.	0.55		
ROUTED TO	S14	72.	14.17	43.	13.	13.	0.55	5.56	14.17
HYDROGRAPH AT	C14	5.	13.33	3.	1.	1.	0.05		
HYDROGRAPH AT	C7	19.	13.33	9.	3.	3.	0.08		
HYDROGRAPH AT	C8	42.	13.00	15.	4.	4.	0.13		
ROUTED TO	S7	42.	13.25	15.	4.	4.	0.13	7.52	13.25
4 COMBINED AT	J@S6	115.	13.92	67.	21.	21.	0.81		
ROUTED TO	S6	114.	14.42	66.	20.	20.	0.81	3.01	14.42
HYDROGRAPH AT	C6	14.	13.25	6.	2.	2.	0.08		
HYDROGRAPH AT	C16	20.	12.83	6.	2.	2.	0.05		
ROUTED TO	S16	20.	12.92	6.	2.	2.	0.05	3.44	12.92
HYDROGRAPH AT	C17	7.	12.58	2.	1.	1.	0.02		
ROUTED TO	S17	7.	12.67	2.	1.	1.	0.02	5.68	12.67
4 COMBINED AT	J@TWES	130.	14.33	76.	25.	25.	0.96		
ROUTED TO	TWEST	101.	15.33	75.	25.	25.	0.96	3.59	15.33
ROUTED TO	S5	100.	15.75	75.	24.	24.	0.96	2.26	15.75

HYDROGRAPH AT	C18	5.	13.25	2.	1.	1.	0.03		
HYDROGRAPH AT	C5	12.	12.83	4.	1.	1.	0.05		
HYDROGRAPH AT	C19	8.	14.25	5.	1.	1.	0.04		
ROUTED TO	S18	8.	15.00	5.	1.	1.	0.04	2.28	15.00
4 COMBINED AT	J@S4	112.	15.58	83.	27.	27.	1.09		
ROUTED TO	S4	110.	16.42	82.	25.	25.	1.09	2.89	16.42
HYDROGRAPH AT	C4	13.	13.00	5.	2.	2.	0.07		
2 COMBINED AT	J@S3	113.	16.42	84.	27.	27.	1.17		
ROUTED TO	S3	111.	17.42	82.	24.	24.	1.17	2.93	17.42
HYDROGRAPH AT	C24	9.	13.42	4.	1.	1.	0.04		
HYDROGRAPH AT	C25	7.	13.58	4.	1.	1.	0.03		
2 COMBINED AT	J@S23	16.	13.50	8.	2.	2.	0.07		
ROUTED TO	S23	11.	16.25	8.	2.	2.	0.07	4.89	16.25
HYDROGRAPH AT	C26	16.	13.67	8.	3.	3.	0.07		
HYDROGRAPH AT	C23	8.	13.33	3.	1.	1.	0.03		
3 COMBINED AT	J@S20	32.	13.58	19.	6.	6.	0.17		
ROUTED TO	S20	26.	16.00	19.	6.	6.	0.17	6.28	16.00
HYDROGRAPH AT	C20	10.	12.83	3.	1.	1.	0.03		
HYDROGRAPH AT	C3	16.	13.75	8.	3.	3.	0.09		
HYDROGRAPH AT	C22	17.	12.75	5.	1.	1.	0.04		
ROUTED TO	S21	10.	15.00	4.	1.	1.	0.04	8.34	15.00
HYDROGRAPH AT	C21	20.	13.25	9.	3.	3.	0.11		
2 COMBINED AT	J@S20A	20.	13.25	12.	4.	4.	0.14		
ROUTED TO	S20A	20.	13.42	12.	4.	4.	0.14	1.47	13.42
5 COMBINED AT	J@S2	146.	17.17	107.	38.	38.	1.60		
ROUTED TO	S2	145.	17.58	107.	36.	36.	1.60	3.02	17.58
HYDROGRAPH AT	C2	31.	12.58	8.	2.	2.	0.07		
2 COMBINED AT	J@R14	148.	17.58	108.	38.	38.	1.67		
ROUTED TO	S1	147.	17.92	108.	37.	37.	1.67	3.93	17.92
HYDROGRAPH AT	C1	66.	12.42	13.	4.	4.	0.08		
2 COMBINED AT	J@MAT	150.	17.83	111.	41.	41.	1.75		

*** NORMAL END OF HEC-1 ***

HEC1 S/N: 1343000043   HMVersion: 6.33   Data File: C:\WESTPT\WPF2IN.PRN

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****************************************                                          ***************************************
*                                      *                                          *                                     *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                          *   U.S. ARMY CORPS OF ENGINEERS      *
*              MAY   1991              *                                          *   HYDROLOGIC ENGINEERING CENTER     *
*           VERSION 4.0.1E             *                                          *         609 SECOND STREET           *
*                                      *                                          *      DAVIS, CALIFORNIA 95616        *
*  RUN DATE  08/19/1993  TIME  11:43:51 *                                         *          (916) 756-1104             *
*                                      *                                          *                                     *
****************************************                                          ***************************************


                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X        X     X         XX
                                        X     X  X        X                X
                                        XXXXXXX  XXXX     X        XXXXX   X
                                        X     X  X        X                X
                                        X     X  X        X     X          X
                                        X     X  XXXXXXX   XXXXX          XXX


                                    ::::::::::::::::::::::::::::::::::::::::::
                                    ::::::::::::::::::::::::::::::::::::::::::
                                    :::                                    :::
                                    :::  Full Microcomputer Implementation :::
                                    :::                by                  :::
                                    :::        Haestad Methods, Inc.       :::
                                    :::                                    :::
                                    ::::::::::::::::::::::::::::::::::::::::::
                                    ::::::::::::::::::::::::::::::::::::::::::

                     37 Brookside Road * Waterbury, Connecticut  06708 * (203) 755-1666
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID    WEST POINT CREEK     FUTURE CONDITIONS
  2           ID    L&M JOB 92-093       2-YEAR STORM
              *DIAGRAM
  3           IT       5                      288
  4           IO       5
              *
              *

  5           KK     C11
  6           BA   0.168
              * 2-YEAR STORM       VDOT
              *                    0.47    0.95     1.6    2.06    2.28    2.52    2.76    2.88
              * 2-YEAR STORM        NWS
  7           PH                     0.47    0.95     1.6    1.81    2.02    2.55    3.03     3.5
              * 10-YEAR STORM      VDOT
              *                     0.6    1.28     2.3    2.96    3.27     3.6    3.96    4.08
              * 10-YEAR STORM       NWS
              *                     0.6    1.28    2.28    2.61    2.95     3.8    4.56    5.33
              * 25-YEAR STORM      VDOT
              *                    0.68    1.49    2.71     3.5    3.87    4.38    4.56     4.8
              * 25-YEAR STORM       NWS
              *                    0.68    1.49    2.68    3.08    3.49    4.53    5.45    6.38
              * 100-YEAR STORM     VDOT
              *                    0.81    1.81    3.35    4.32    4.77    5.16    5.64    5.76
              * 100-YEAR STORM      NWS
              *                    0.81    1.81     3.3    3.82    4.33    5.65    6.83       8
  8           LS              81
  9           UD   1.188

 10           KK     S11
 11           RS       3    FLOW      -1
 12           RC    0.07    0.05    0.07    1400   0.003
 13           RX     175     240   271.5  273.25  276.76   278.5     320     410
 14           RY      16      14    13.5    11.9    11.9    13.5      14    16.1

 15           KK     C10
 16           BA     0.1
 17           LS              78
 18           UD    1.32

 19           KK   J@MAG   COMBINE S11 AND C10
 20           HC       2
              *    MAG   CULVERT AT MAGNOLIA
              *      1    ELEV       ?
              *
              *
              *

 21           KK     S10
 22           RS            FLOW      -1
 23           RC   0.085   0.045   0.085     440   0.003
 24           RX       0      80     127   128.5   131.5     133     270     400
 25           RY      14      12   10.07    9.33    9.33   10.07      12      14
```

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LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  26           KK      C9
  27           BA    0.06
  28           LS               86
  29           UD   0.756
               *   MAGW   CULVERT AT MAGNOLIA-WEST
               *      1    ELEV       ?
               *
               *
               *

  30           KK      S9
  31           RS       4    FLOW      -1
  32           RC   0.085   0.045   0.085    1050   0.003
  33           RX       0      80     127   128.5   131.5     133     270     400
  34           RY      14      12   10.07    9.47    9.47   10.07      12      14

  35           KK     C12
  36           BA   0.095
  37           LS               77
  38           UD    2.04
               *   MAGE   CULVERT AT MAGNOLIA-EAST
               *      1    ELEV       ?
               *
               *
               *

  39           KK     S12
  40           RS       7    FLOW      -1
  41           RC   0.085    0.05   0.085    1000  0.0008
  42           RX     100     160   165.5     170   174.5     180     270     360
  43           RY      10       8     7.9    6.88     7.9       8       9      10

  44           KK   J@C13 COMBINE S9, S10, AND S12
  45           HC       3

  46           KK     C13
  47           BA   0.062
  48           LS               73
  49           UD    0.81

  50           KK     C15
  51           BA   0.066
  52           LS               77
  53           UD   0.558

  54           KK   J@S14   COMBINE J@C13, C13, AND C15
  55           HC       3

  56           KK     S14
  57           RS      18    FLOW      -1
  58           RC   0.105   0.065   0.105    1550  0.0012
  59           RX     210     230     280     285     289     295     410     420
  60           RY       8       6       4    3.75    3.75       4       6       8
```

```
LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  61           KK     C14
  62           BA   0.045
  63           LS                75
  64           UD   1.026

  65           KK      C7
  66           BA   0.084
  67           LS                77
  68           UD   0.888

  69           KK      C8
  70           BA   0.131
  71           LS                85
  72           UD   0.726

  73           KK      S7
  74           RS      10    FLOW      -1
  75           RC   0.105   0.065   0.105    1450  0.0032
  76           RX     150     170     185     223     227     255     275     310
  77           RY      12      10       8    6.15    6.15       8      10      12

  78           KK    J@S6   COMBINE C14, S14, C7, AND S7
  79           HC       4

  80           KK      S6
  81           RS      20    FLOW      -1
  82           RC   0.105   0.065   0.105    1900  0.0011
  83           RX     230     330     335     387     392     435     440     510
  84           RY       8       2     1.9     1.7     1.7     1.9       2       8

  85           KK      C6
  86           BA   0.083
  87           LS                77
  88           UD   0.792

  89           KK     C16
  90           BA    0.05
  91           LS                78
  92           UD   0.348
               * ODI-N   CULVERT AT ODI-NORTH
               *     1    ELEV       ?
               *
               *
               *

  93           KK     S16
  94           RS       2    FLOW      -1
  95           RC   0.105   0.065   0.105     450  0.0125
  96           RX     155     180   197.5     198     202   202.5     215     265
  97           RY       8       4    2.54    2.49    2.49    2.54       4       8
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


  98          KK     C17
  99          BA   0.021
 100          LS              72
 101          UD   0.174
              *  ODI-S   CULVERT AT ODI-SOUTH
              *      1    ELEV       ?
              *
              *
              *

 102          KK     S17
 103          RS       2    FLOW      -1
 104          RC    0.03    0.03    0.03     660    0.01
 105          RX       0     180     260     264     266     268     280     320
 106          RY     9.9       8     6.5       5       5     6.5       7       8

 107          KK  J@TWEST  COMBINE C6, S6, S16, S17
 108          HC       4

 109          KK   TWEST   CULVERT AT THOMPSON-WEST
 110          RS       1    ELEV       3
 111          SA    4.82    7.54     9.3    9.37    9.56    9.87   10.31   10.89   12.54   14.73
 112          SA   17.29   20.18   30.73   31.35   32.92   34.33   35.43   36.69    38.1    39.2
 113          SE     1.8       2       3    3.04    3.15    3.33    3.58    3.91    4.32    4.79
 114          SE    5.34    5.96    6.66     6.7     6.8    6.89    6.96    7.04    7.13     7.2
 115          SQ       0       0       0      25      50      75     100     125     150     175
 116          SQ     200     225     250     350     400     450     500     560     630     700

 117          KK      S5
 118          RS       4    FLOW      -1
 119          RC    0.06    0.04    0.06    1700  0.0005
 120          RX     110     145     150     155     340     345     350     365
 121          RY       6       4       2     1.5     1.5       2       4       6

 122          KK     C18
 123          BA   0.034
 124          LS              74
 125          UD   0.786

 126          KK      C5
 127          BA   0.052
 128          LS              79
 129          UD    0.57

 130          KK     C19
 131          BA   0.042
 132          LS              80
 133          UD   0.792
              *  TEAST   CULVERT AT THOMPSON-EAST
              *      1    ELEV       ?
              *
              *
              *
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 134          KK     S18
 135          RS       6    FLOW      -1
 136          RC    0.07   0.065    0.07    2300  0.0067
 137          RX     200     215     230     240     270     285     295     305
 138          RY       8       6       4       2       2       4       6       8

 139          KK    J@S4   COMBINE C18, C5, S5, AND S18
 140          HC       4

 141          KK      S4
 142          RS       7    FLOW      -1
 143          RC    0.06    0.04    0.06    2800  0.0005
 144          RX      68      78      88     170     320     330     340     380
 145          RY       8       6       4       2       2       4       6       8

 146          KK      C4
 147          BA   0.074
 148          LS              87
 149          UD   0.792

 150          KK    J@S3   COMBINE S4 AND C4
 151          HC       2

 152          KK      S3
 153          RS       9    FLOW      -1
 154          RC    0.06    0.04    0.06    3700  0.0005
 155          RX     110     125     155     178     325     335     347     357
 156          RY       8       6       4       2       2       4       6       8

 157          KK     C24
 158          BA   0.036
 159          LS              83
 160          UD   1.032

 161          KK     C25
 162          BA   0.031
 163          LS              86
 164          UD   1.272

 165          KK   J@S23   COMBINE C24 AND C25
 166          HC       2

 167          KK     S23
 168          RS       5    FLOW      -1
 169          RC   0.095   0.055   0.095    1600  0.0008
 170          RX       0      10      50      51      55      56     356     656
 171          RY     5.8     5.8     4.8     2.8     2.8     4.8     4.9       5

 172          KK     C26
 173          BA   0.068
 174          LS              84
 175          UD   1.284
```

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 176          KK     C23
 177          BA    0.03
 178          LS              95
 179          UD   1.062

 180          KK    J@S20   COMBINE C23, C26, AND S23
 181          HC       3

 182          KK     S20
 183          RS      10    FLOW      -1
 184          RC   0.065    0.06   0.065    2000  0.0004
 185          RX       0      50     250  250.25  255.75     256     386     406
 186          RY     7.2     6.2       6     2.5     2.5       6     6.2     7.2

 187          KK     C20
 188          BA   0.032
 189          LS              82
 190          UD   0.702

 191          KK      C3
 192          BA   0.095
 193          LS              77
 194          UD   1.284

 195          KK     C22
 196          BA   0.035
 197          LS              81
 198          UD   0.504
              *     OAK   CULVERT AT OAK LANE
              *       1    ELEV       ?
              *
              *
              *

 199          KK     S21
 200          RS      16    FLOW      -1
 201          RC   0.065   0.045   0.065    3800  0.0006
 202          RX       0      70      90     150     220     240     315     390
 203          RY    10.5    11.5      10       8       8      10    10.4    10.8

 204          KK     C21
 205          BA   0.107
 206          LS              87
 207          UD   1.092

 208          KK   J@S20A   COMBINE S21 AND C21
 209          HC       2

 210          KK    S20A
 211          RS       2    FLOW      -1
 212          RC   0.065    0.06   0.065     400  0.0004
 213          RX      40      46      55      65      85      95     125     150
 214          RY       8       6       4       2       0       0       2       4
```

```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 215         KK    J@S2   COMBINE S20A, C3, S20, C20, AND S3
 216         HC       5

 217         KK      S2
 218         RS       4    FLOW      -1
 219         RC    0.06    0.04    0.06    1750  0.0005
 220         RX      50      90     110     150     310     340     380     390
 221         RY       8       6       4       2       2       4       6       8

 222         KK      C2
 223         BA   0.067
 224         LS               84
 225         UD   0.498

 226         KK   J@R14   COMBINE C2 AND S2
 227         HC       2
             *    R14   CULVERT AT 14TH STREET
             *      1    ELEV       ?
             *
             *
             *

 228         KK      S1
 229         RS       4    FLOW      -1
 230         RC    0.06    0.04    0.06    1800  0.0005
 231         RX       0     0.1      50      82     132     139     146     186
 232         RY       5       5       4       2       2       4       6       8

 233         KK      C1
 234         BA   0.078
 235         LS               85
 236         UD   0.378

 237         KK   J@MAT COMBINE S1 AND C1
 238         HC       2
 239         ZZ
```

```
                SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    5         C11
                V
                V
   10         S11
                .
                .
   15           .         C10
                .           .
                .           .
   19       J@MAG............
                V
                V
   21         S10
                .
                .
   26           .          C9
                .           V
                .           V
   30           .          S9
                .           .
                .           .
   35           .           .          C12
                .           .           V
                .           .           V
   39           .           .          S12
                .           .           .
                .           .           .
   44       J@C13........................
                .
                .
   46           .         C13
                .           .
                .           .
   50           .           .          C15
                .           .           .
                .           .           .
   54       J@S14........................
                V
                V
   56         S14
                .
                .
   61           .         C14
                .           .
                .           .
   65           .           .           C7
                .           .           .
                .           .           .
   69           .           .           .          C8
                .           .           .           V
                .           .           .           V
   73           .           .           .          S7
                .           .           .           .
                .           .           .           .
   78        J@S6....................................
                V
```

```
              .
 80          S6
              .
              .
 85           .          C6
              .           .
              .           .
 89           .           .         C16
              .           .           V
              .           .           V
 93           .           .         S16
              .           .           .
              .           .           .
 98           .           .           .         C17
              .           .           .           V
              .           .           .           V
102           .           .           .         S17
              .           .           .           .
              .           .           .           .
107      J@TWES....................................
              V
              V
109       TWEST
              V
              V
117          S5
              .
              .
122           .         C18
              .           .
              .           .
126           .           .          C5
              .           .           .
              .           .           .
130           .           .           .         C19
              .           .           .           V
              .           .           .           V
134           .           .           .         S18
              .           .           .           .
              .           .           .           .
139        J@S4....................................
              V
              V
141          S4
              .
              .
146           .          C4
              .           .
              .           .
150        J@S3............
              V
              V
152          S3
              .
              .
157           .         C24
              .           .
              .           .
161           .           .         C25
              .           .           .
              .           .           .
165           .       J@S23............
              .           V
              .           V
167           .         S23
              .           .
```

```
172           .           .         C26
              .           .           .
              .           .           .
176           .           .           .         C23
              .           .           .           .
              .           .           .           .
180           .       J@S20........................
              .           V
              .           V
182           .         S20
              .           .
              .           .
187           .           .         C20
              .           .           .
              .           .           .
191           .           .           .          C3
              .           .           .           .
              .           .           .           .
195           .           .           .           .         C22
              .           .           .           .           V
              .           .           .           .           V
199           .           .           .           .         S21
              .           .           .           .           .
              .           .           .           .           .
204           .           .           .           .           .         C21
              .           .           .           .           .           .
              .           .           .           .           .           .
208           .           .           .           .      J@S20A............
              .           .           .           .           V
              .           .           .           .           V
210           .           .           .           .        S20A
              .           .           .           .           .
              .           .           .           .           .
215        J@S2................................................
              V
              V
217          S2
              .
              .
222           .          C2
              .           .
              .           .
226       J@R14............
              V
              V
228          S1
              .
              .
233           .          C1
              .           .
              .           .
237       J@MAT............
(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
HEC1 S/N: 1343000043       HMVersion: 6.33    Data File: C:\WESTPT\WPF2IN.PRN

****************************************                                          ***************************************
*                                      *                                          *                                     *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                          *   U.S. ARMY CORPS OF ENGINEERS      *
*              MAY   1991              *                                          *   HYDROLOGIC ENGINEERING CENTER     *
*           VERSION 4.0.1E             *                                          *         609 SECOND STREET           *
*                                      *                                          *      DAVIS, CALIFORNIA 95616        *
*  RUN DATE  08/19/1993  TIME  11:43:51 *                                          *          (916) 756-1104             *
*                                      *                                          *                                     *
****************************************                                          ***************************************



                          WEST POINT CREEK     FUTURE CONDITIONS
                          L&M JOB 92-093       2-YEAR STORM

   4 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1   0  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      1   0  ENDING DATE
                      NDTIME       2355  ENDING TIME
                       ICENT         19  CENTURY MARK

                    COMPUTATION INTERVAL    0.08 HOURS
                         TOTAL TIME BASE   23.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C11	61.	13.25	25.	8.	8.	0.17		
ROUTED TO	S11	58.	13.58	25.	8.	8.	0.17	14.26	13.58
HYDROGRAPH AT	C10	29.	13.42	13.	4.	4.	0.10		
2 COMBINED AT	J@MAG	86.	13.50	38.	11.	11.	0.27		
ROUTED TO	S10	85.	13.67	38.	11.	11.	0.27	11.35	13.67
HYDROGRAPH AT	C9	38.	12.75	11.	3.	3.	0.06		
ROUTED TO	S9	36.	13.08	11.	3.	3.	0.06	10.92	13.08
HYDROGRAPH AT	C12	19.	14.25	11.	3.	3.	0.09		
ROUTED TO	S12	18.	14.83	11.	3.	3.	0.09	8.60	14.83
3 COMBINED AT	J@C13	118.	13.58	60.	18.	18.	0.42		
HYDROGRAPH AT	C13	19.	12.83	6.	2.	2.	0.06		
HYDROGRAPH AT	C15	34.	12.58	8.	3.	3.	0.07		
3 COMBINED AT	J@S14	140.	13.42	74.	23.	23.	0.55		
ROUTED TO	S14	139.	13.83	74.	22.	22.	0.55	6.08	13.83
HYDROGRAPH AT	C14	13.	13.08	5.	2.	2.	0.05		
HYDROGRAPH AT	C7	31.	12.92	11.	3.	3.	0.08		
HYDROGRAPH AT	C8	81.	12.75	23.	7.	7.	0.13		
ROUTED TO	S7	80.	13.00	23.	7.	7.	0.13	7.93	13.00
4 COMBINED AT	J@S6	210.	13.33	111.	34.	34.	0.81		
ROUTED TO	S6	209.	13.75	111.	33.	33.	0.81	3.51	13.75
HYDROGRAPH AT	C6	33.	12.83	11.	3.	3.	0.08		
HYDROGRAPH AT	C16	36.	12.33	7.	2.	2.	0.05		
ROUTED TO	S16	36.	12.42	7.	2.	2.	0.05	3.74	12.42
HYDROGRAPH AT	C17	15.	12.17	2.	1.	1.	0.02		
ROUTED TO	S17	15.	12.17	2.	1.	1.	0.02	6.01	12.17
4 COMBINED AT	J@TWES	230.	13.67	125.	39.	39.	0.96		
ROUTED TO	TWEST	152.	15.17	121.	39.	39.	0.96	4.35	15.17
ROUTED TO	S5	151.	15.50	120.	38.	38.	0.96	2.47	15.50

HYDROGRAPH AT	C18	12.	12.83	4.	1.	1.	0.03		
HYDROGRAPH AT	C5	29.	12.58	7.	2.	2.	0.05		
HYDROGRAPH AT	C19	20.	12.83	6.	2.	2.	0.04		
ROUTED TO	S18	19.	13.25	6.	2.	2.	0.04	2.48	13.25
4 COMBINED AT	J@S4	162.	15.33	130.	43.	43.	1.09		
ROUTED TO	S4	161.	16.00	129.	41.	41.	1.09	3.11	16.00
HYDROGRAPH AT	C4	47.	12.75	14.	4.	4.	0.07		
2 COMBINED AT	J@S3	166.	15.92	134.	45.	45.	1.17		
ROUTED TO	S3	165.	16.67	133.	42.	42.	1.17	3.17	16.67
HYDROGRAPH AT	C24	16.	13.08	6.	2.	2.	0.04		
HYDROGRAPH AT	C25	13.	13.33	6.	2.	2.	0.03		
2 COMBINED AT	J@S23	29.	13.17	12.	3.	3.	0.07		
ROUTED TO	S23	16.	16.00	12.	3.	3.	0.07	4.99	16.00
HYDROGRAPH AT	C26	27.	13.33	11.	3.	3.	0.07		
HYDROGRAPH AT	C23	20.	13.00	7.	2.	2.	0.03		
3 COMBINED AT	J@S20	54.	13.17	30.	9.	9.	0.17		
ROUTED TO	S20	43.	15.25	29.	9.	9.	0.17	6.44	15.25
HYDROGRAPH AT	C20	18.	12.75	5.	2.	2.	0.03		
HYDROGRAPH AT	C3	26.	13.33	12.	4.	4.	0.09		
HYDROGRAPH AT	C22	23.	12.50	5.	2.	2.	0.04		
ROUTED TO	S21	12.	14.50	5.	1.	1.	0.04	8.38	14.50
HYDROGRAPH AT	C21	53.	13.08	20.	6.	6.	0.11		
2 COMBINED AT	J@S20A	54.	13.08	24.	8.	8.	0.14		
ROUTED TO	S20A	53.	13.25	24.	8.	8.	0.14	2.29	13.25
5 COMBINED AT	J@S2	220.	16.17	178.	64.	64.	1.60		
ROUTED TO	S2	219.	16.50	178.	62.	62.	1.60	3.30	16.50
HYDROGRAPH AT	C2	51.	12.50	11.	3.	3.	0.07		
2 COMBINED AT	J@R14	222.	16.50	181.	66.	66.	1.67		
ROUTED TO	S1	222.	16.83	180.	64.	64.	1.67	4.36	16.83
HYDROGRAPH AT	C1	73.	12.33	14.	4.	4.	0.08		
2 COMBINED AT	J@MAT	225.	16.83	183.	68.	68.	1.75		

*** NORMAL END OF HEC-1 ***

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HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\WPF10IN.PRN

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*                                       *                                            *                                     *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                            *   U.S. ARMY CORPS OF ENGINEERS      *
*              MAY   1991               *                                            *   HYDROLOGIC ENGINEERING CENTER     *
*           VERSION 4.0.1E              *                                            *         609 SECOND STREET           *
*                                       *                                            *     DAVIS, CALIFORNIA 95616         *
*  RUN DATE  08/19/1993  TIME  11:42:53 *                                            *         (916) 756-1104              *
*                                       *                                            *                                     *
*****************************************                                            ***************************************


                              WEST POINT CREEK     FUTURE CONDITIONS
                              L&M JOB 92-093       10-YEAR STORM

   4 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1   0  ENDING DATE
                     NDTIME       2355  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL    0.08 HOURS
                      TOTAL TIME BASE   23.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C11	112.	13.17	47.	15.	15.	0.17		
ROUTED TO	S11	109.	13.50	47.	14.	14.	0.17	14.61	13.50
HYDROGRAPH AT	C10	56.	13.33	26.	8.	8.	0.10		
2 COMBINED AT	J@MAG	164.	13.42	72.	22.	22.	0.27		
ROUTED TO	S10	163.	13.58	72.	22.	22.	0.27	11.79	13.58
HYDROGRAPH AT	C9	63.	12.75	19.	6.	6.	0.06		
ROUTED TO	S9	60.	13.00	19.	6.	6.	0.06	11.17	13.00
HYDROGRAPH AT	C12	37.	14.17	23.	7.	7.	0.09		
ROUTED TO	S12	37.	14.67	22.	7.	7.	0.09	8.92	14.67
3 COMBINED AT	J@C13	225.	13.50	113.	35.	35.	0.42		
HYDROGRAPH AT	C13	42.	12.83	14.	4.	4.	0.06		
HYDROGRAPH AT	C15	65.	12.58	17.	5.	5.	0.07		
3 COMBINED AT	J@S14	272.	13.25	142.	45.	45.	0.55		
ROUTED TO	S14	272.	13.67	142.	44.	44.	0.55	6.74	13.67
HYDROGRAPH AT	C14	27.	13.08	11.	3.	3.	0.05		
HYDROGRAPH AT	C7	61.	12.92	21.	6.	6.	0.08		
HYDROGRAPH AT	C8	137.	12.75	41.	13.	13.	0.13		
ROUTED TO	S7	137.	12.92	41.	13.	13.	0.13	8.30	12.92
4 COMBINED AT	J@S6	427.	13.17	212.	66.	66.	0.81		
ROUTED TO	S6	427.	13.50	212.	65.	65.	0.81	4.37	13.50
HYDROGRAPH AT	C6	65.	12.83	21.	6.	6.	0.08		
HYDROGRAPH AT	C16	67.	12.33	13.	4.	4.	0.05		
ROUTED TO	S16	66.	12.42	13.	4.	4.	0.05	4.14	12.42
HYDROGRAPH AT	C17	32.	12.17	5.	1.	1.	0.02		
ROUTED TO	S17	31.	12.17	5.	1.	1.	0.02	6.44	12.17
4 COMBINED AT	J@TWES	475.	13.50	246.	77.	77.	0.96		
ROUTED TO	TWEST	228.	15.50	208.	76.	76.	0.96	6.05	15.50
ROUTED TO	S5	228.	15.83	207.	75.	75.	0.96	2.74	15.83

HYDROGRAPH AT	C18	24.	12.83	8.	2.	2.	0.03		
HYDROGRAPH AT	C5	54.	12.58	14.	4.	4.	0.05		
HYDROGRAPH AT	C19	36.	12.75	11.	4.	4.	0.04		
ROUTED TO	S18	35.	13.08	11.	4.	4.	0.04	2.72	13.08
4 COMBINED AT	J@S4	246.	15.33	224.	85.	85.	1.09		
ROUTED TO	S4	246.	15.92	223.	82.	82.	1.09	3.42	15.92
HYDROGRAPH AT	C4	77.	12.75	24.	8.	8.	0.07		
2 COMBINED AT	J@S3	256.	15.67	233.	89.	89.	1.17		
ROUTED TO	S3	255.	16.33	233.	84.	84.	1.17	3.52	16.33
HYDROGRAPH AT	C24	28.	13.00	11.	3.	3.	0.04		
HYDROGRAPH AT	C25	23.	13.25	10.	3.	3.	0.03		
2 COMBINED AT	J@S23	50.	13.08	20.	6.	6.	0.07		
ROUTED TO	S23	33.	15.08	20.	6.	6.	0.07	5.11	15.08
HYDROGRAPH AT	C26	47.	13.25	20.	6.	6.	0.07		
HYDROGRAPH AT	C23	30.	13.00	11.	4.	4.	0.03		
3 COMBINED AT	J@S20	84.	13.17	50.	16.	16.	0.17		
ROUTED TO	S20	74.	14.58	48.	16.	16.	0.17	6.64	14.58
HYDROGRAPH AT	C20	32.	12.67	9.	3.	3.	0.03		
HYDROGRAPH AT	C3	53.	13.33	24.	7.	7.	0.09		
HYDROGRAPH AT	C22	42.	12.50	10.	3.	3.	0.04		
ROUTED TO	S21	28.	13.92	9.	3.	3.	0.04	8.62	13.92
HYDROGRAPH AT	C21	89.	13.08	35.	11.	11.	0.11		
2 COMBINED AT	J@S20A	90.	13.08	43.	14.	14.	0.14		
ROUTED TO	S20A	89.	13.17	43.	14.	14.	0.14	2.86	13.17
5 COMBINED AT	J@S2	374.	14.50	322.	124.	124.	1.60		
ROUTED TO	S2	372.	14.92	322.	121.	121.	1.60	3.76	14.92
HYDROGRAPH AT	C2	87.	12.50	20.	6.	6.	0.07		
2 COMBINED AT	J@R14	383.	14.92	328.	128.	128.	1.67		
ROUTED TO	S1	382.	15.25	328.	125.	125.	1.67	5.06	15.25
HYDROGRAPH AT	C1	122.	12.33	24.	8.	8.	0.08		
2 COMBINED AT	J@MAT	392.	15.17	334.	133.	133.	1.75		

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HEC1 S/N: 1343000043       HMVersion: 6.33    Data File: C:\WESTPT\WP10EXIN.PRN

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*                                      *                     *                                      *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                     *    U.S. ARMY CORPS OF ENGINEERS      *
*             MAY   1991               *                     *    HYDROLOGIC ENGINEERING CENTER     *
*           VERSION 4.0.1E             *                     *          609 SECOND STREET           *
*                                      *                     *       DAVIS, CALIFORNIA 95616        *
* RUN DATE  08/19/1993  TIME  10:32:36 *                     *          (916) 756-1104              *
*                                      *                     *                                      *
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                        WEST POINT CREEK     EXISTING CONDITIONS
                        L&M JOB 92-093       10-YEAR STORM

   4 IO        OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT        HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1   0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      1   0  ENDING DATE
                    NDTIME       2355  ENDING TIME
                     ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   23.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C11	53.	13.67	29.	9.	9.	0.17		
ROUTED TO	S11	52.	14.08	29.	9.	9.	0.17	14.20	14.08
HYDROGRAPH AT	C10	40.	13.50	19.	6.	6.	0.10		
2 COMBINED AT	J@MAG	88.	13.83	48.	15.	15.	0.27		
ROUTED TO	S10	87.	14.00	48.	15.	15.	0.27	11.36	14.00
HYDROGRAPH AT	C9	37.	12.83	13.	4.	4.	0.06		
ROUTED TO	S9	36.	13.17	13.	4.	4.	0.06	10.92	13.17
HYDROGRAPH AT	C12	23.	14.92	16.	5.	5.	0.09		
ROUTED TO	S12	23.	15.50	16.	5.	5.	0.09	8.70	15.50
3 COMBINED AT	J@C13	120.	13.83	75.	24.	24.	0.42		
HYDROGRAPH AT	C13	24.	13.08	10.	3.	3.	0.06		
HYDROGRAPH AT	C15	35.	13.25	15.	5.	5.	0.07		
3 COMBINED AT	J@S14	167.	13.50	100.	31.	31.	0.55		
ROUTED TO	S14	167.	13.92	99.	31.	31.	0.55	6.24	13.92
HYDROGRAPH AT	C14	16.	13.25	7.	2.	2.	0.05		
HYDROGRAPH AT	C7	41.	13.33	18.	6.	6.	0.08		
HYDROGRAPH AT	C8	87.	12.92	31.	9.	9.	0.13		
ROUTED TO	S7	86.	13.17	31.	9.	9.	0.13	7.99	13.17
4 COMBINED AT	J@S6	275.	13.58	152.	48.	48.	0.81		
ROUTED TO	S6	274.	14.00	152.	46.	46.	0.81	3.80	14.00
HYDROGRAPH AT	C6	36.	13.17	15.	5.	5.	0.08		
HYDROGRAPH AT	C16	39.	12.83	13.	4.	4.	0.05		
ROUTED TO	S16	39.	12.83	13.	4.	4.	0.05	3.80	12.83
HYDROGRAPH AT	C17	16.	12.58	4.	1.	1.	0.02		
ROUTED TO	S17	16.	12.67	4.	1.	1.	0.02	6.04	12.67
4 COMBINED AT	J@TWES	315.	13.92	177.	56.	56.	0.96		
ROUTED TO	TWEST	185.	15.75	162.	56.	56.	0.96	5.01	15.75

HYDROGRAPH AT	C18	14.	13.17	6.	2.	2.	0.03		
HYDROGRAPH AT	C5	29.	12.83	10.	3.	3.	0.05		
HYDROGRAPH AT	C19	16.	14.17	10.	3.	3.	0.04		
ROUTED TO	S18	16.	14.58	10.	3.	3.	0.04	2.44	14.58
4 COMBINED AT	J@S4	205.	15.50	179.	62.	62.	1.09		
ROUTED TO	S4	205.	16.08	178.	59.	59.	1.09	3.28	16.08
HYDROGRAPH AT	C4	33.	13.00	13.	4.	4.	0.07		
2 COMBINED AT	J@S3	211.	16.00	183.	63.	63.	1.17		
ROUTED TO	S3	211.	16.67	182.	59.	59.	1.17	3.36	16.67
HYDROGRAPH AT	C24	19.	13.42	9.	3.	3.	0.04		
HYDROGRAPH AT	C25	15.	13.58	7.	2.	2.	0.03		
2 COMBINED AT	J@S23	33.	13.42	16.	5.	5.	0.07		
ROUTED TO	S23	22.	15.67	16.	5.	5.	0.07	5.04	15.67
HYDROGRAPH AT	C26	33.	13.58	17.	5.	5.	0.07		
HYDROGRAPH AT	C23	16.	13.25	7.	2.	2.	0.03		
3 COMBINED AT	J@S20	57.	13.50	38.	12.	12.	0.17		
ROUTED TO	S20	50.	15.17	36.	12.	12.	0.17	6.49	15.17
HYDROGRAPH AT	C20	22.	12.83	7.	2.	2.	0.03		
HYDROGRAPH AT	C3	36.	13.67	19.	6.	6.	0.09		
HYDROGRAPH AT	C22	32.	12.67	9.	3.	3.	0.04		
ROUTED TO	S21	23.	14.25	9.	3.	3.	0.04	8.56	14.25
HYDROGRAPH AT	C21	48.	13.17	20.	6.	6.	0.11		
2 COMBINED AT	J@S20A	50.	14.17	28.	9.	9.	0.14		
ROUTED TO	S20A	49.	14.25	28.	9.	9.	0.14	2.22	14.25
5 COMBINED AT	J@S2	288.	16.33	242.	88.	88.	1.60		
ROUTED TO	S2	287.	16.67	242.	85.	85.	1.60	3.52	16.67
HYDROGRAPH AT	C2	63.	12.50	16.	5.	5.	0.07		
2 COMBINED AT	J@R14	292.	16.67	246.	90.	90.	1.67		
ROUTED TO	S1	291.	16.92	245.	88.	88.	1.67	4.69	16.92
HYDROGRAPH AT	C1	113.	12.33	23.	7.	7.	0.08		
2 COMBINED AT	J@MAT	297.	16.92	250.	95.	95.	1.75		

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HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\WP25EXIN.PRN

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*                                       *                           *                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                           *   U.S. ARMY CORPS OF ENGINEERS        *
*              MAY   1991               *                           *   HYDROLOGIC ENGINEERING CENTER       *
*            VERSION 4.0.1E             *                           *         609 SECOND STREET             *
*                                       *                           *      DAVIS, CALIFORNIA 95616          *
*  RUN DATE  08/19/1993  TIME  10:44:53 *                           *          (916) 756-1104               *
*                                       *                           *                                       *
*****************************************                           *****************************************


                      WEST POINT CREEK     EXISTING CONDITIONS
                      L&M JOB 92-093       25-YEAR STORM

  4 IO         OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT         HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      1    0  ENDING DATE
                    NDTIME       2355  ENDING TIME
                     ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   23.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C11	75.	13.67	40.	12.	12.	0.17		
ROUTED TO	S11	74.	14.00	40.	12.	12.	0.17	14.38	14.00
HYDROGRAPH AT	C10	55.	13.42	26.	8.	8.	0.10		
2 COMBINED AT	J@MAG	123.	13.83	66.	20.	20.	0.27		
ROUTED TO	S10	122.	13.92	66.	20.	20.	0.27	11.58	13.92
HYDROGRAPH AT	C9	50.	12.83	17.	5.	5.	0.06		
ROUTED TO	S9	48.	13.17	17.	5.	5.	0.06	11.06	13.17
HYDROGRAPH AT	C12	32.	14.83	22.	7.	7.	0.09		
ROUTED TO	S12	32.	15.42	22.	7.	7.	0.09	8.85	15.42
3 COMBINED AT	J@C13	167.	13.83	103.	33.	33.	0.42		
HYDROGRAPH AT	C13	34.	13.08	14.	4.	4.	0.06		
HYDROGRAPH AT	C15	46.	13.17	20.	6.	6.	0.07		
3 COMBINED AT	J@S14	234.	13.50	136.	43.	43.	0.55		
ROUTED TO	S14	233.	13.92	136.	42.	42.	0.55	6.57	13.92
HYDROGRAPH AT	C14	22.	13.25	10.	3.	3.	0.05		
HYDROGRAPH AT	C7	54.	13.33	24.	8.	8.	0.08		
HYDROGRAPH AT	C8	114.	12.92	40.	13.	13.	0.13		
ROUTED TO	S7	113.	13.08	40.	12.	12.	0.13	8.16	13.08
4 COMBINED AT	J@S6	377.	13.58	207.	65.	65.	0.81		
ROUTED TO	S6	376.	13.92	207.	64.	64.	0.81	4.19	13.92
HYDROGRAPH AT	C6	49.	13.17	21.	6.	6.	0.08		
HYDROGRAPH AT	C16	51.	12.75	16.	5.	5.	0.05		
ROUTED TO	S16	51.	12.83	16.	5.	5.	0.05	3.97	12.83
HYDROGRAPH AT	C17	21.	12.58	6.	2.	2.	0.02		
ROUTED TO	S17	21.	12.58	6.	2.	2.	0.02	6.20	12.58
4 COMBINED AT	J@TWES	436.	13.83	243.	77.	77.	0.96		
ROUTED TO	TWEST	224.	16.00	205.	76.	76.	0.96	5.94	16.00

HYDROGRAPH AT	C18	20.	13.17	8.	3.	3.	0.03		
HYDROGRAPH AT	C5	40.	12.75	13.	4.	4.	0.05		
HYDROGRAPH AT	C19	21.	14.17	13.	4.	4.	0.04		
ROUTED TO	S18	21.	14.50	13.	4.	4.	0.04	2.52	14.50
4 COMBINED AT	J@S4	250.	15.50	226.	85.	85.	1.09		
ROUTED TO	S4	249.	16.08	226.	81.	81.	1.09	3.43	16.08
HYDROGRAPH AT	C4	47.	13.00	17.	5.	5.	0.07		
2 COMBINED AT	J@S3	258.	15.92	233.	86.	86.	1.17		
ROUTED TO	S3	258.	16.58	232.	81.	81.	1.17	3.53	16.58
HYDROGRAPH AT	C24	24.	13.42	11.	4.	4.	0.04		
HYDROGRAPH AT	C25	19.	13.50	10.	3.	3.	0.03		
2 COMBINED AT	J@S23	44.	13.42	21.	7.	7.	0.07		
ROUTED TO	S23	31.	15.42	20.	6.	6.	0.07	5.10	15.42
HYDROGRAPH AT	C26	43.	13.58	22.	7.	7.	0.07		
HYDROGRAPH AT	C23	21.	13.25	9.	3.	3.	0.03		
3 COMBINED AT	J@S20	72.	13.50	49.	16.	16.	0.17		
ROUTED TO	S20	66.	15.00	47.	16.	16.	0.17	6.59	15.00
HYDROGRAPH AT	C20	29.	12.83	9.	3.	3.	0.03		
HYDROGRAPH AT	C3	49.	13.67	26.	8.	8.	0.09		
HYDROGRAPH AT	C22	41.	12.67	12.	4.	4.	0.04		
ROUTED TO	S21	32.	14.08	11.	3.	3.	0.04	8.67	14.08
HYDROGRAPH AT	C21	66.	13.17	28.	8.	8.	0.11		
2 COMBINED AT	J@S20A	73.	13.92	38.	12.	12.	0.14		
ROUTED TO	S20A	73.	14.00	38.	12.	12.	0.14	2.62	14.00
5 COMBINED AT	J@S2	364.	16.00	314.	119.	119.	1.60		
ROUTED TO	S2	364.	16.25	313.	116.	116.	1.60	3.74	16.25
HYDROGRAPH AT	C2	82.	12.50	21.	6.	6.	0.07		
2 COMBINED AT	J@R14	370.	16.25	319.	122.	122.	1.67		
ROUTED TO	S1	370.	16.50	318.	119.	119.	1.67	5.02	16.50
HYDROGRAPH AT	C1	141.	12.33	29.	9.	9.	0.08		
2 COMBINED AT	J@MAT	377.	16.50	325.	129.	129.	1.75		

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HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\WPF25IN.PRN

****************************************                                     ****************************************
*                                      *                                     *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                     *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY   1991              *                                     *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.0.1E            *                                     *         609 SECOND STREET            *
*                                      *                                     *      DAVIS, CALIFORNIA 95616         *
* RUN DATE  08/19/1993  TIME  11:41:55 *                                     *          (916) 756-1104              *
*                                      *                                     *                                      *
****************************************                                     ****************************************



                            WEST POINT CREEK     FUTURE CONDITIONS
                            L&M JOB 92-093       25-YEAR STORM

   4 IO         OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     1    0  ENDING DATE
                     NDTIME       2355  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL    0.08 HOURS
                      TOTAL TIME BASE   23.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C11	142.	13.17	60.	19.	19.	0.17		
ROUTED TO	S11	139.	13.50	60.	19.	19.	0.17	14.77	13.50
HYDROGRAPH AT	C10	73.	13.33	33.	10.	10.	0.10		
2 COMBINED AT	J@MAG	211.	13.42	93.	29.	29.	0.27		
ROUTED TO	S10	209.	13.50	93.	29.	29.	0.27	11.98	13.50
HYDROGRAPH AT	C9	78.	12.75	24.	8.	8.	0.06		
ROUTED TO	S9	75.	13.00	24.	8.	8.	0.06	11.29	13.00
HYDROGRAPH AT	C12	49.	14.17	29.	9.	9.	0.09		
ROUTED TO	S12	48.	14.67	29.	9.	9.	0.09	9.07	14.67
3 COMBINED AT	J@C13	288.	13.50	145.	46.	46.	0.42		
HYDROGRAPH AT	C13	55.	12.83	18.	6.	6.	0.06		
HYDROGRAPH AT	C15	84.	12.58	22.	7.	7.	0.07		
3 COMBINED AT	J@S14	354.	13.25	184.	58.	58.	0.55		
ROUTED TO	S14	353.	13.58	183.	57.	57.	0.55	7.07	13.58
HYDROGRAPH AT	C14	36.	13.00	14.	4.	4.	0.05		
HYDROGRAPH AT	C7	79.	12.92	27.	8.	8.	0.08		
HYDROGRAPH AT	C8	170.	12.67	51.	16.	16.	0.13		
ROUTED TO	S7	169.	12.83	51.	16.	16.	0.13	8.47	12.83
4 COMBINED AT	J@S6	561.	13.17	273.	86.	86.	0.81		
ROUTED TO	S6	559.	13.50	273.	85.	85.	0.81	4.78	13.50
HYDROGRAPH AT	C6	84.	12.75	27.	8.	8.	0.08		
HYDROGRAPH AT	C16	86.	12.33	17.	5.	5.	0.05		
ROUTED TO	S16	84.	12.42	17.	5.	5.	0.05	4.33	12.42
HYDROGRAPH AT	C17	41.	12.17	6.	2.	2.	0.02		
ROUTED TO	S17	41.	12.17	6.	2.	2.	0.02	6.59	12.17
4 COMBINED AT	J@TWES	624.	13.42	319.	100.	100.	0.96		
ROUTED TO	TWEST	354.	15.00	252.	99.	99.	0.96	6.71	15.00

HYDROGRAPH AT	C18	32.	12.75	10.	3.	3.	0.03		
HYDROGRAPH AT	C5	69.	12.58	18.	6.	6.	0.05		
HYDROGRAPH AT	C19	46.	12.75	15.	5.	5.	0.04		
ROUTED TO	S18	45.	13.08	15.	5.	5.	0.04	2.83	13.08
4 COMBINED AT	J@S4	375.	15.25	272.	110.	110.	1.09		
ROUTED TO	S4	363.	15.83	272.	106.	106.	1.09	3.77	15.83
HYDROGRAPH AT	C4	95.	12.75	30.	10.	10.	0.07		
2 COMBINED AT	J@S3	375.	15.75	286.	115.	115.	1.17		
ROUTED TO	S3	366.	16.42	286.	109.	109.	1.17	3.88	16.42
HYDROGRAPH AT	C24	35.	13.00	13.	4.	4.	0.04		
HYDROGRAPH AT	C25	28.	13.25	12.	4.	4.	0.03		
2 COMBINED AT	J@S23	62.	13.08	26.	8.	8.	0.07		
ROUTED TO	S23	42.	14.83	25.	8.	8.	0.07	5.17	14.83
HYDROGRAPH AT	C26	58.	13.25	26.	8.	8.	0.07		
HYDROGRAPH AT	C23	35.	13.00	14.	5.	5.	0.03		
3 COMBINED AT	J@S20	102.	13.17	62.	21.	21.	0.17		
ROUTED TO	S20	93.	14.42	61.	21.	21.	0.17	6.74	14.42
HYDROGRAPH AT	C20	40.	12.67	12.	4.	4.	0.03		
HYDROGRAPH AT	C3	68.	13.33	31.	10.	10.	0.09		
HYDROGRAPH AT	C22	52.	12.50	13.	4.	4.	0.04		
ROUTED TO	S21	38.	13.83	12.	4.	4.	0.04	8.74	13.83
HYDROGRAPH AT	C21	110.	13.08	43.	14.	14.	0.11		
2 COMBINED AT	J@S20A	118.	13.58	54.	18.	18.	0.14		
ROUTED TO	S20A	117.	13.67	54.	17.	17.	0.14	3.21	13.67
5 COMBINED AT	J@S2	497.	14.17	408.	160.	160.	1.60		
ROUTED TO	S2	493.	14.42	407.	156.	156.	1.60	4.06	14.42
HYDROGRAPH AT	C2	108.	12.50	26.	8.	8.	0.07		
2 COMBINED AT	J@R14	508.	14.42	416.	164.	164.	1.67		
ROUTED TO	S1	505.	14.67	416.	161.	161.	1.67	5.49	14.67
HYDROGRAPH AT	C1	150.	12.33	31.	10.	10.	0.08		
2 COMBINED AT	J@MAT	521.	14.67	425.	171.	171.	1.75		

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HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\WP100EXN.PRN

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*                                      *                                  *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                  *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY   1991              *                                  *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E             *                                  *         609 SECOND STREET            *
*                                      *                                  *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE  08/19/1993  TIME  10:31:13 *                                 *          (916) 756-1104              *
*                                      *                                  *                                      *
****************************************                                  ****************************************


                    WEST POINT CREEK     EXISTING CONDITIONS
                    L&M JOB 92-093       100-YEAR STORM

   4 IO         OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1   0  ENDING DATE
                     NDTIME       2355  ENDING TIME
                      ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   23.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C11	110.	13.67	58.	18.	18.	0.17		
ROUTED TO	S11	109.	13.92	58.	18.	18.	0.17	14.61	13.92
HYDROGRAPH AT	C10	79.	13.42	38.	12.	12.	0.10		
2 COMBINED AT	J@MAG	180.	13.75	95.	30.	30.	0.27		
ROUTED TO	S10	179.	13.83	95.	30.	30.	0.27	11.85	13.83
HYDROGRAPH AT	C9	71.	12.83	24.	7.	7.	0.06		
ROUTED TO	S9	68.	13.17	24.	7.	7.	0.06	11.24	13.17
HYDROGRAPH AT	C12	46.	14.83	32.	10.	10.	0.09		
ROUTED TO	S12	46.	15.33	32.	10.	10.	0.09	9.04	15.33
3 COMBINED AT	J@C13	246.	13.75	149.	47.	47.	0.42		
HYDROGRAPH AT	C13	51.	13.08	21.	6.	6.	0.06		
HYDROGRAPH AT	C15	65.	13.17	27.	9.	9.	0.07		
3 COMBINED AT	J@S14	343.	13.50	196.	62.	62.	0.55		
ROUTED TO	S14	342.	13.83	195.	61.	61.	0.55	7.03	13.83
HYDROGRAPH AT	C14	33.	13.25	15.	4.	4.	0.05		
HYDROGRAPH AT	C7	76.	13.25	34.	11.	11.	0.08		
HYDROGRAPH AT	C8	157.	12.92	56.	17.	17.	0.13		
ROUTED TO	S7	156.	13.08	56.	17.	17.	0.13	8.40	13.08
4 COMBINED AT	J@S6	552.	13.50	295.	94.	94.	0.81		
ROUTED TO	S6	550.	13.83	295.	92.	92.	0.81	4.75	13.83
HYDROGRAPH AT	C6	72.	13.17	30.	9.	9.	0.08		
HYDROGRAPH AT	C16	69.	12.75	22.	7.	7.	0.05		
ROUTED TO	S16	69.	12.83	22.	7.	7.	0.05	4.18	12.83
HYDROGRAPH AT	C17	30.	12.58	8.	2.	2.	0.02		
ROUTED TO	S17	30.	12.58	8.	2.	2.	0.02	6.41	12.58
4 COMBINED AT	J@TWES	639.	13.75	349.	111.	111.	0.96		
ROUTED TO	TWEST	386.	15.33	274.	108.	108.	0.96	6.77	15.33

HYDROGRAPH AT	C18	29.	13.17	12.	4.	4.	0.03		
HYDROGRAPH AT	C5	59.	12.75	19.	6.	6.	0.05		
HYDROGRAPH AT	C19	29.	14.08	18.	6.	6.	0.04		
ROUTED TO	S18	29.	14.42	17.	6.	6.	0.04	2.65	14.42
4 COMBINED AT	J@S4	426.	15.50	303.	120.	120.	1.09		
ROUTED TO	S4	422.	16.00	303.	114.	114.	1.09	3.93	16.00
HYDROGRAPH AT	C4	69.	12.92	25.	8.	8.	0.07		
2 COMBINED AT	J@S3	435.	15.92	314.	122.	122.	1.17		
ROUTED TO	S3	430.	16.50	314.	114.	114.	1.17	4.06	16.50
HYDROGRAPH AT	C24	34.	13.33	16.	5.	5.	0.04		
HYDROGRAPH AT	C25	27.	13.50	13.	4.	4.	0.03		
2 COMBINED AT	J@S23	60.	13.42	29.	9.	9.	0.07		
ROUTED TO	S23	45.	15.08	27.	9.	9.	0.07	5.18	15.08
HYDROGRAPH AT	C26	59.	13.58	30.	9.	9.	0.07		
HYDROGRAPH AT	C23	29.	13.25	13.	4.	4.	0.03		
3 COMBINED AT	J@S20	96.	13.50	68.	22.	22.	0.17		
ROUTED TO	S20	92.	14.83	66.	22.	22.	0.17	6.74	14.83
HYDROGRAPH AT	C20	40.	12.75	13.	4.	4.	0.03		
HYDROGRAPH AT	C3	70.	13.67	36.	11.	11.	0.09		
HYDROGRAPH AT	C22	54.	12.67	16.	5.	5.	0.04		
ROUTED TO	S21	45.	13.92	16.	5.	5.	0.04	8.82	13.92
HYDROGRAPH AT	C21	95.	13.17	40.	12.	12.	0.11		
2 COMBINED AT	J@S20A	114.	13.75	55.	17.	17.	0.14		
ROUTED TO	S20A	113.	13.83	55.	17.	17.	0.14	3.17	13.83
5 COMBINED AT	J@S2	569.	16.42	439.	169.	169.	1.60		
ROUTED TO	S2	566.	16.67	438.	164.	164.	1.60	4.22	16.67
HYDROGRAPH AT	C2	113.	12.50	29.	9.	9.	0.07		
2 COMBINED AT	J@R14	574.	16.67	447.	173.	173.	1.67		
ROUTED TO	S1	571.	16.92	446.	170.	170.	1.67	5.70	16.92
HYDROGRAPH AT	C1	183.	12.33	39.	12.	12.	0.08		
2 COMBINED AT	J@MAT	580.	16.92	456.	182.	182.	1.75		

HEC1 S/N: 1343000043   HMVersion: 6.33   Data File: C:\WESTPT\WPF100IN.PRN

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*                                      *                 *                                      *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                 *   U.S. ARMY CORPS OF ENGINEERS       *
*            MAY   1991                *                 *   HYDROLOGIC ENGINEERING CENTER      *
*          VERSION 4.0.1E              *                 *         609 SECOND STREET            *
*                                      *                 *      DAVIS, CALIFORNIA 95616         *
* RUN DATE  08/19/1993  TIME  11:40:56 *                 *          (916) 756-1104              *
*                                      *                 *                                      *
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                          WEST POINT CREEK     FUTURE CONDITIONS
                          L&M JOB 92-093       100-YEAR STORM

   4 IO           OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT           HYDROGRAPH TIME DATA
                         NMIN          5  MINUTES IN COMPUTATION INTERVAL
                        IDATE     1    0  STARTING DATE
                        ITIME       0000  STARTING TIME
                           NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     1    0  ENDING DATE
                       NDTIME       2355  ENDING TIME
                        ICENT         19  CENTURY MARK

                    COMPUTATION INTERVAL    0.08 HOURS
                         TOTAL TIME BASE   23.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C11	189.	13.17	80.	25.	25.	0.17		
ROUTED TO	S11	186.	13.42	80.	25.	25.	0.17	14.98	13.42
HYDROGRAPH AT	C10	99.	13.33	45.	14.	14.	0.10		
2 COMBINED AT	J@MAG	284.	13.42	125.	40.	40.	0.27		
ROUTED TO	S10	282.	13.50	125.	39.	39.	0.27	12.24	13.50
HYDROGRAPH AT	C9	100.	12.75	31.	10.	10.	0.06		
ROUTED TO	S9	97.	13.00	31.	10.	10.	0.06	11.44	13.00
HYDROGRAPH AT	C12	67.	14.17	40.	13.	13.	0.09		
ROUTED TO	S12	67.	14.58	40.	13.	13.	0.09	9.26	14.58
3 COMBINED AT	J@C13	389.	13.42	195.	62.	62.	0.42		
HYDROGRAPH AT	C13	77.	12.83	25.	8.	8.	0.06		
HYDROGRAPH AT	C15	113.	12.58	30.	9.	9.	0.07		
3 COMBINED AT	J@S14	483.	13.17	248.	80.	80.	0.55		
ROUTED TO	S14	481.	13.50	248.	78.	78.	0.55	7.54	13.50
HYDROGRAPH AT	C14	50.	13.00	19.	6.	6.	0.05		
HYDROGRAPH AT	C7	107.	12.92	37.	12.	12.	0.08		
HYDROGRAPH AT	C8	220.	12.67	68.	22.	22.	0.13		
ROUTED TO	S7	220.	12.83	68.	22.	22.	0.13	8.71	12.83
4 COMBINED AT	J@S6	774.	13.17	369.	118.	118.	0.81		
ROUTED TO	S6	772.	13.42	369.	116.	116.	0.81	5.37	13.42
HYDROGRAPH AT	C6	115.	12.75	37.	12.	12.	0.08		
HYDROGRAPH AT	C16	115.	12.33	23.	7.	7.	0.05		
ROUTED TO	S16	113.	12.33	23.	7.	7.	0.05	4.58	12.33
HYDROGRAPH AT	C17	57.	12.17	8.	3.	3.	0.02		
ROUTED TO	S17	56.	12.17	8.	3.	3.	0.02	6.77	12.17
4 COMBINED AT	J@TWES	863.	13.33	433.	137.	137.	0.96		
ROUTED TO	TWEST	576.	14.50	353.	135.	135.	0.96	7.06	14.50

HYDROGRAPH AT	C18	44.	12.75	14.	4.	4.	0.03		
HYDROGRAPH AT	C5	92.	12.58	24.	8.	8.	0.05		
HYDROGRAPH AT	C19	62.	12.75	20.	6.	6.	0.04		
ROUTED TO	S18	60.	13.00	20.	6.	6.	0.04	2.99	13.00
4 COMBINED AT	J@S4	615.	14.67	390.	150.	150.	1.09		
ROUTED TO	S4	610.	15.08	389.	145.	145.	1.09	4.32	15.08
HYDROGRAPH AT	C4	122.	12.75	39.	13.	13.	0.07		
2 COMBINED AT	J@S3	633.	15.00	414.	157.	157.	1.17		
ROUTED TO	S3	627.	15.50	412.	150.	150.	1.17	4.54	15.50
HYDROGRAPH AT	C24	46.	13.00	18.	6.	6.	0.04		
HYDROGRAPH AT	C25	36.	13.25	16.	5.	5.	0.03		
2 COMBINED AT	J@S23	82.	13.08	34.	11.	11.	0.07		
ROUTED TO	S23	61.	14.50	32.	11.	11.	0.07	5.25	14.50
HYDROGRAPH AT	C26	76.	13.25	34.	11.	11.	0.07		
HYDROGRAPH AT	C23	44.	13.00	17.	6.	6.	0.03		
3 COMBINED AT	J@S20	130.	13.17	81.	28.	28.	0.17		
ROUTED TO	S20	124.	14.42	80.	27.	27.	0.17	6.89	14.42
HYDROGRAPH AT	C20	53.	12.67	16.	5.	5.	0.03		
HYDROGRAPH AT	C3	93.	13.33	42.	13.	13.	0.09		
HYDROGRAPH AT	C22	69.	12.50	17.	5.	5.	0.04		
ROUTED TO	S21	53.	13.67	17.	5.	5.	0.04	8.90	13.67
HYDROGRAPH AT	C21	141.	13.08	57.	18.	18.	0.11		
2 COMBINED AT	J@S20A	167.	13.50	72.	23.	23.	0.14		
ROUTED TO	S20A	166.	13.58	72.	23.	23.	0.14	3.75	13.58
5 COMBINED AT	J@S2	829.	15.42	592.	218.	218.	1.60		
ROUTED TO	S2	824.	15.67	591.	214.	214.	1.60	4.70	15.67
HYDROGRAPH AT	C2	140.	12.50	34.	11.	11.	0.07		
2 COMBINED AT	J@R14	836.	15.67	605.	225.	225.	1.67		
ROUTED TO	S1	833.	15.83	605.	221.	221.	1.67	6.43	15.83
HYDROGRAPH AT	C1	193.	12.33	40.	13.	13.	0.08		
2 COMBINED AT	J@MAT	845.	15.83	619.	234.	234.	1.75		

```
      ID  THOMPSON TRIB. TO MATTAPONI          FUTURE CONDITIONS
ID  L&M JOB 92-093              100-YEAR STORM
*DIAGRAM
IT     5                    288
IO     5
*
*
KK   C40
BA 0.038
* 2-YEAR STORM - NWS
*                    0.47    0.95     1.6    1.81    2.02    2.35    3.03     3.5
* 10-YEAR STORM
*                     0.6    1.28    2.28    2.61    2.95     3.8    4.56    5.33
* 25-YEAR STORM
*                    0.68    1.49    2.68    3.08    3.49    4.53    5.45    6.38
* 100-YEAR STORM
PH                   0.81    1.81     3.3    3.82    4.33    5.65    6.83       8
LS            74
UD  0.44
*    R40   CULVERT AT DRIVEWAY - R30
*      1    ELEV      ?
*
*
*
KK   C39
BA 0.045
LS            76
UD 0.318
*    R39   CULVERT AT CHELSEA - R39
*      1    ELEV      ?
*
*
*
KK J0837 COMBINE R39 AND R40
HC     2
KK   R37
RS     4    FLOW     -1
RC  0.08   -0.05   0.08    1300   0.007
RX    24      40     55     105     120     125     131     141
RY     8       6      4       2       2       4       6       8
KK   C37
BA 0.019
LS            75
UD 0.456
KK   C36
BA 0.027
LS            82
UD 0.918
KK   C35
BA 0.012
LS            82
UD  0.39
*    R35   CULVERT AT DRIVEWAY - R35
*      1    ELEV      ?
*
*
*
KK   R36
RS    12    FLOW     -1
RC  0.08    0.05   0.08     880 0.00025
RX     0      70     80      92     158     160     168     260
RY     6       4      2     1.5     1.5       2       4     5.5
KK J0838 COMBINE R37, C37, C36, AND R36
```

```
KK   S38
RS    16    FLOW      -1
RC  0.06    0.04    0.06    1180 0.00025
RX   110     208     220     315     330     560     570     584
RY     6       2     1.3     1.2     1.2     1.3       2       6
KK   C38
BA 0.028
LS             60
UD 0.738
KK J@END COMBINE S38 AND C38
HC     2
ZZ
```

```
ID  MAGNOLIA TRIB. TO MATTAPONI          FUTURE CONDITIONS
ID  L&M JOB 92-093       100-YEAR STORM
*DIAGRAM
IT     5                     288
IO     5
*
*
KK   C27
BA 0.059
* 2-YEAR STORM
*                  0.47    0.95     1.6    1.81    2.02    2.55    3.03     3.5
* 10-YEAR STORM
*                   0.6    1.28    2.28    2.61    2.95     3.8    4.56    5.33
* 25-YEAR STORM
*                  0.68    1.49    2.68    3.06    3.49    4.53    5.45    6.38
* 100-YEAR STORM
PH                 0.81    1.81     3.3    3.82    4.33    5.65    6.83       8
LS             82
UD 0.516
*  BAGBY   CULVERT AT BAGBY - R27
*       1    ELEV       ?
*
*
*
KK   S28
RS      3    FLOW      -1
RC 0.065   0.065   0.065    1410   0.006
RX   214     222     239     240     242     243     260     294
RY     8       6       6     2.5     2.5       6       6       8
KK   C28
BA 0.074
LS             75
UD 0.558
KK J@R28 COMBINE S28 AND C28
HC      2
KKCHEL28   CULVERT AT CHELSEA - R28
RS      1    ELEV       3
SA      0    0.19    0.51    0.82    1.48    2.13    2.62    3.27     3.6
SE  1.17       2       3       4       5       6    6.66    7.55    7.97
SQ      0      11      24      37      52      57      74     200     400
KK  S285
RS      6    FLOW      -1
RC  0.07    0.05    0.07    1690   0.004
RX      0      30      32     125     135     210     214     230
*       8       2       0    -0.5    -0.5    -0.2       2       8
RY   8.5     2.5     0.5       0       0     0.3     2.5     8.5
KK  C285
BA 0.055
LS             71
UD 0.552
KK J@END COMBINE S285 AND C285
HC      2
ZZ
```

```
ID  NORTH CHELSEA TRIB. TO MATTAPONI     FUTURE CONDITIONS
ID  L&M JOB 92-093             100-YEAR STORM
*DIAGRAM
IT     5                    286
IO     5
*
*
KK   C29
BA 0.039
* 2-YEAR STORM
*                   0.47    0.95     1.6     1.81    2.02    2.55    3.03     3.5
* 10-YEAR STORM
*                    0.6    1.28    2.28    2.61    2.95     3.8    4.56    5.33
* 25-YEAR STORM
*                   0.68    1.49    2.68    3.08    3.49    4.53    5.45    6.38
* 100-YEAR STORM
PH                  0.81    1.81     3.3    3.82    4.33    5.65    6.83       8
LS            80
UD 0.534
KK   C30
BA 0.047
LS            72
UD 0.306
*    R30   CULVERT AT CHELSEA - R30
*      1    ELEV       ?
*
*
*
KK J@S31 COMBINE C29 AND R30
HC     2
KK   S31
RS     3    FLOW      -1
RC  0.09    0.05    0.09    2020   0.005
RX    90     130     146     160     172     186     210     260
RY    10       8       6       4       4       6       8      10
KK   C34
BA 0.433
LS            78
UD 0.936
KK   C31
BA 0.031
LS            84
UD 0.618
KK   C33
BA  0.05
LS            75
UD 0.804
KK J@R33 COMBINE C34, S31, C31, AND C33
HC     4
KK   R33   CULVERT AT CHELSEA - R33
RS     1    ELEV       3
SA  7.44    9.42   11.39   11.87   12.29   12.61    13.3
SE     2       3       4    4.25    4.47    4.64       5
SQ    37      47     100     300     400     500     700
KK   S32
RS     5    FLOW      -1
RC  0.07    0.04    0.07    2890   0.005
RX    40      90     120     300     320     350     372     380
RY     4       2     1.1       1       1     1.1       2       4
KK   C32
BA 0.063
LS            78
UD 0.912
```

HEC1 S/N: 1343000043   HMVersion: 6.33   Data File: C:\WESTPT\THEX100N.PRN

```
*****************************************                                          *****************************************
*                                       *                                          *                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                          *   U.S. ARMY CORPS OF ENGINEERS        *
*              MAY   1991               *                                          *   HYDROLOGIC ENGINEERING CENTER       *
*            VERSION 4.0.1E             *                                          *         609 SECOND STREET             *
*                                       *                                          *      DAVIS, CALIFORNIA 95616          *
*  RUN DATE  08/20/1993  TIME  08:35:43 *                                          *         (916) 756-1104                *
*                                       *                                          *                                       *
*****************************************                                          *****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X       XXXXX   X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

```
:::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::
:::                                     :::
:::  Full Microcomputer Implementation  :::
:::                 by                  :::
:::         Haestad Methods, Inc.       :::
:::                                     :::
:::::::::::::::::::::::::::::::::::::::::::
:::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1          ID   THOMPSON TRIB. TO MATTAPONI         EXISTING CONDITIONS
  2          ID   L&M JOB 92-093               100-YEAR STORM
             *DIAGRAM
  3          IT       5                 288
  4          IO       5
             *
             *

  5          KK     C40
  6          BA   0.038
             * 2-YEAR STORM - NWS
             *                   0.47    0.95     1.6    1.81    2.02    2.55    3.03     3.5
             * 10-YEAR STORM
             *                    0.6    1.28    2.28    2.61    2.95     3.8    4.56    5.33
             * 25-YEAR STORM
             *                   0.68    1.49    2.68    3.08    3.49    4.53    5.45    6.38
             * 100-YEAR STORM
  7          PH                     0.81    1.81     3.3    3.82    4.33    5.65    6.83       8
  8          LS              72
  9          UD   1.392
             *    R40   CULVERT AT DRIVEWAY - R30
             *      1    ELEV       ?
             *
             *
             *

 10          KK     C39
 11          BA   0.045
 12          LS              85
 13          UD   0.936
             *    R39   CULVERT AT CHELSEA - R39
             *      1    ELEV       ?
             *
             *
             *

 14          KK   J@S37 COMBINE R39 AND R40
 15          HC       2

 16          KK     S37
 17          RS       4    FLOW      -1
 18          RC    0.08    0.05    0.08    1300   0.007
 19          RX      24      40      55     105     120     125     131     141
 20          RY       8       6       4       2       2       4       6       8

 21          KK     C37
 22          BA   0.019
 23          LS              70
 24          UD   0.516
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 25           KK     C36
 26           BA   0.027
 27           LS               79
 28           UD    1.14

 29           KK     C35
 30           BA   0.012
 31           LS               82
 32           UD   0.534
              *    R35   CULVERT AT DRIVEWAY - R35
              *      1    ELEV        ?
              *
              *
              *

 33           KK     S36
 34           RS      12    FLOW      -1
 35           RC    0.08    0.05    0.08     880 0.00025
 36           RX       0      70      80      92     158     160     168     260
 37           RY       6       4       2     1.5     1.5       2       4     5.5

 38           KK   J@S38 COMBINE S37, C37, C36, AND S36
 39           HC       4

 40           KK     S38
 41           RS      16    FLOW      -1
 42           RC    0.06    0.04    0.06    1180 0.00025
 43           RX     110     208     220     315     330     560     570     584
 44           RY       6       2     1.3     1.2     1.2     1.3       2       6

 45           KK     C38
 46           BA   0.028
 47           LS               69
 48           UD   1.116

 49           KK   J@END COMBINE S38 AND C38
 50           HC       2
 51           ZZ
```

```
               SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   5        C40
             .
             .
  10         .          C39
             .           .
             .           .
  14      J@S37...........
             V
             V
  16        S37
             .
             .
  21         .          C37
             .           .
             .           .
  25         .           .          C36
             .           .           .
             .           .           .
  29         .           .           .          C35
             .           .           .           V
             .           .           .           V
  33         .           .           .          S36
             .           .           .           .
             .           .           .           .
  38      J@S38...................................
             V
             V
  40        S38
             .
             .
  45         .          C38
             .           .
             .           .
  49      J@END...........

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

HEC1 S/N: 1343000043   HMVersion: 6.33   Data File: C:\WESTPT\THEX100N.PRN

```
****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY   1991              *                    *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E             *                    *         609 SECOND STREET            *
*                                      *                    *      DAVIS, CALIFORNIA 95616         *
* RUN DATE  08/20/1993  TIME  08:35:43 *                    *          (916) 756-1104              *
*                                      *                    *                                      *
****************************************                    ****************************************
```

```
                    THOMPSON TRIB. TO MATTAPONI         EXISTING CONDITIONS
                    L&M JOB 92-093               100-YEAR STORM

  4 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1    0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     1    0  ENDING DATE
                   NDTIME       2355  ENDING TIME
                    ICENT         19  CENTURY MARK

              COMPUTATION INTERVAL    0.08 HOURS
                   TOTAL TIME BASE   23.92 HOURS

       ENGLISH UNITS
            DRAINAGE AREA         SQUARE MILES
            PRECIPITATION DEPTH   INCHES
            LENGTH, ELEVATION     FEET
            FLOW                  CUBIC FEET PER SECOND
            STORAGE VOLUME        ACRE-FEET
            SURFACE AREA          ACRES
            TEMPERATURE           DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C40	31.	13.42	15.	5.	5.	0.04		
HYDROGRAPH AT	C39	64.	12.92	23.	7.	7.	0.05		
2 COMBINED AT	J@S37	91.	13.00	38.	12.	12.	0.08		
ROUTED TO	S37	90.	13.17	38.	12.	12.	0.08	3.27	13.17
HYDROGRAPH AT	C37	29.	12.50	7.	2.	2.	0.02		
HYDROGRAPH AT	C36	30.	13.17	12.	4.	4.	0.03		
HYDROGRAPH AT	C35	23.	12.50	6.	2.	2.	0.01		
ROUTED TO	S36	22.	12.92	6.	2.	2.	0.01	2.27	12.92
4 COMBINED AT	J@S38	155.	13.00	63.	20.	20.	0.14		
ROUTED TO	S38	153.	13.42	63.	20.	20.	0.14	2.09	13.42
HYDROGRAPH AT	C38	25.	13.17	10.	3.	3.	0.03		
2 COMBINED AT	J@END	176.	13.42	74.	23.	23.	0.17		

HEC1 S/N: 1343000043 HMVersion: 6.33 Data File: C:\WESTPT\THF100IN.FRN

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              MAY   1991               *
*           VERSION 4.0.1E              *
*                                       *
* RUN DATE  08/20/1993  TIME  08:35:10  *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*     U.S. ARMY CORPS OF ENGINEERS      *
*     HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

```
                THOMPSON TRIB. TO MATTAPONI         FUTURE CONDITIONS
               L&M JOB 92-093              100-YEAR STORM

  4 IO        OUTPUT CONTROL VARIABLES
                   IPRNT          5  PRINT CONTROL
                   IPLOT          0  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT         HYDROGRAPH TIME DATA
                   NMIN           5  MINUTES IN COMPUTATION INTERVAL
                   IDATE      1   0  STARTING DATE
                   ITIME       0000  STARTING TIME
```

```
          NQ          [illegible]  NUMBER OF HYDROGRAPH ORDINATES
      NDDATE      1     0  ENDING DATE
      NDTIME         2355  ENDING TIME
      ICENT            19  CENTURY MARK

   COMPUTATION INTERVAL    0.08 HOURS
        TOTAL TIME BASE   23.92 HOURS

ENGLISH UNITS
     DRAINAGE AREA          SQUARE MILES
     PRECIPITATION DEPTH    INCHES
     LENGTH, ELEVATION      FEET
     FLOW                   CUBIC FEET PER SECOND
     STORAGE VOLUME         ACRE-FEET
     SURFACE AREA           ACRES
     TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C40	70.	12.42	16.	5.	5.	0.04		
HYDROGRAPH AT	C39	102.	12.33	20.	6.	6.	0.05		
2 COMBINED AT	J@S37	170.	12.33	36.	11.	11.	0.08		
ROUTED TO	S37	167.	12.42	36.	11.	11.	0.08	3.69	12.42
HYDROGRAPH AT	C37	35.	12.42	8.	3.	3.	0.02		
HYDROGRAPH AT	C36	37.	12.92	13.	4.	4.	0.03		
HYDROGRAPH AT	C35	28.	12.33	6.	2.	2.	0.01		
ROUTED TO	S36	26.	12.75	6.	2.	2.	0.01	2.34	12.75
4 COMBINED AT	J@S38	236.	12.50	63.	20.	20.	0.14		
ROUTED TO	S38	235.	12.83	63.	19.	19.	0.14	2.33	12.83
HYDROGRAPH AT	C38	43.	12.75	13.	4.	4.	0.03		
2 COMBINED AT	J@END	277.	12.83	76.	23.	23.	0.17		

HEC1 S/N: 1343000043   HMVersion: 6.33   Data File: C:\WESTPT\THEX25IN.PRN

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****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *    U.S. ARMY CORPS OF ENGINEERS      *
*              MAY  1991               *                    *    HYDROLOGIC ENGINEERING CENTER     *
*           VERSION 4.0.1E             *                    *          609 SECOND STREET           *
*                                      *                    *       DAVIS, CALIFORNIA 95616        *
*  RUN DATE  08/20/1993  TIME  08:58:45 *                   *           (916) 756-1104             *
*                                      *                    *                                      *
****************************************                    ****************************************
```

```
                          THOMPSON TRIB. TO MATTAPONI          EXISTING CONDITIONS
                          L&M JOB 92-093                 25-YEAR STORM

  4 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1    0  ENDING DATE
                     NDTIME       2355  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL    0.08 HOURS
                      TOTAL TIME BASE   23.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C40	22.	13.42	11.	3.	3.	0.04		
HYDROGRAPH AT	C39	49.	12.92	18.	6.	6.	0.05		
2 COMBINED AT	J@S37	68.	13.00	28.	9.	9.	0.08		
ROUTED TO	S37	68.	13.17	28.	9.	9.	0.08	3.09	13.17
HYDROGRAPH AT	C37	21.	12.50	5.	2.	2.	0.02		
HYDROGRAPH AT	C36	22.	13.17	9.	3.	3.	0.03		
HYDROGRAPH AT	C35	18.	12.50	4.	1.	1.	0.01		
ROUTED TO	S36	17.	13.00	4.	1.	1.	0.01	2.15	13.00
4 COMBINED AT	J@S38	115.	13.08	47.	15.	15.	0.14		
ROUTED TO	S38	113.	13.58	46.	14.	14.	0.14	1.95	13.58
HYDROGRAPH AT	C38	17.	13.17	7.	2.	2.	0.03		
2 COMBINED AT	J@END	128.	13.50	53.	16.	16.	0.17		

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HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\THF25IN.PRN

****************************************                              ****************************************
*                                      *                              *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                              *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY   1991              *                              *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E             *                              *         609 SECOND STREET            *
*                                      *                              *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE  08/20/1993  TIME  08:57:07 *                             *          (916) 756-1104              *
*                                      *                              *                                      *
****************************************                              ****************************************


                           THOMPSON TRIB. TO MATTAPONI          FUTURE CONDITIONS
                           L&M JOB 92-093               25-YEAR STORM

   4 IO         OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     1    0  ENDING DATE
                     NDTIME       2355  ENDING TIME
                      ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL    0.08 HOURS
                       TOTAL TIME BASE   23.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C40	51.	12.42	11.	4.	4.	0.04		
HYDROGRAPH AT	C39	76.	12.33	14.	4.	4.	0.05		
2 COMBINED AT	J@S37	125.	12.33	26.	8.	8.	0.08		
ROUTED TO	S37	121.	12.50	26.	8.	8.	0.08	3.45	12.50
HYDROGRAPH AT	C37	26.	12.42	6.	2.	2.	0.02		
HYDROGRAPH AT	C36	28.	12.92	10.	3.	3.	0.03		
HYDROGRAPH AT	C35	21.	12.33	4.	1.	1.	0.01		
ROUTED TO	S36	19.	12.83	4.	1.	1.	0.01	2.21	12.83
4 COMBINED AT	J@S38	170.	12.50	46.	14.	14.	0.14		
ROUTED TO	S38	168.	12.92	46.	14.	14.	0.14	2.13	12.92
HYDROGRAPH AT	C38	32.	12.75	10.	3.	3.	0.03		
2 COMBINED AT	J@END	198.	12.92	55.	17.	17.	0.17		

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HEC1 S/N: 1343000043       HMVersion: 6.33    Data File: C:\WESTPT\THEX10IN.PRN

****************************************                                   ****************************************
*                                      *                                   *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                   *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY   1991              *                                   *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E             *                                   *        609 SECOND STREET             *
*                                      *                                   *     DAVIS, CALIFORNIA 95616          *
*  RUN DATE  08/20/1993  TIME  08:59:19 *                                  *         (916) 756-1104               *
*                                      *                                   *                                      *
****************************************                                   ****************************************




                              THOMPSON TRIB. TO MATTAPONI          EXISTING CONDITIONS
                              L&M JOB 92-093              10-YEAR STORM

   4 IO         OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     1    0  ENDING DATE
                     NDTIME       2355  ENDING TIME
                      ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL    0.08 HOURS
                       TOTAL TIME BASE   23.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C40	16.	13.50	8.	2.	2.	0.04		
HYDROGRAPH AT	C39	40.	12.92	14.	4.	4.	0.05		
2 COMBINED AT	J@S37	53.	13.00	22.	7.	7.	0.08		
ROUTED TO	S37	53.	13.17	22.	7.	7.	0.08	2.98	13.17
HYDROGRAPH AT	C37	15.	12.50	4.	1.	1.	0.02		
HYDROGRAPH AT	C36	17.	13.17	7.	2.	2.	0.03		
HYDROGRAPH AT	C35	14.	12.50	3.	1.	1.	0.01		
ROUTED TO	S36	13.	13.00	3.	1.	1.	0.01	2.07	13.00
4 COMBINED AT	J@S38	90.	13.08	36.	11.	11.	0.14		
ROUTED TO	S38	88.	13.58	36.	11.	11.	0.14	1.85	13.58
HYDROGRAPH AT	C38	13.	13.17	5.	2.	2.	0.03		
2 COMBINED AT	J@END	99.	13.58	41.	12.	12.	0.17		

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HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\THF10IN.PRN

****************************************                                        ****************************************
*                                      *                                        *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                        *   U.S. ARMY CORPS OF ENGINEERS       *
*             MAY   1991               *                                        *   HYDROLOGIC ENGINEERING CENTER      *
*          VERSION 4.0.1E              *                                        *         609 SECOND STREET            *
*                                      *                                        *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE  08/20/1993  TIME  08:57:40 *                                       *          (916) 756-1104              *
*                                      *                                        *                                      *
****************************************                                        ****************************************



                         THOMPSON TRIB. TO MATTAPONI          FUTURE CONDITIONS
                         L&M JOB 92-093               10-YEAR STORM

  4 IO         OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT         HYDROGRAPH TIME DATA
                      NMIN           5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME        0000  STARTING TIME
                        NQ         288  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      1    0  ENDING DATE
                    NDTIME        2355  ENDING TIME
                     ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL    0.08 HOURS
                      TOTAL TIME BASE   23.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C40	39.	12.42	9.	3.	3.	0.04		
HYDROGRAPH AT	C39	59.	12.33	11.	3.	3.	0.05		
2 COMBINED AT	J@S37	96.	12.33	20.	6.	6.	0.08		
ROUTED TO	S37	93.	12.50	20.	6.	6.	0.08	3.29	12.50
HYDROGRAPH AT	C37	20.	12.42	4.	1.	1.	0.02		
HYDROGRAPH AT	C36	22.	12.92	8.	2.	2.	0.03		
HYDROGRAPH AT	C35	17.	12.33	3.	1.	1.	0.01		
ROUTED TO	S36	15.	12.92	3.	1.	1.	0.01	2.11	12.92
4 COMBINED AT	J@S38	130.	12.50	35.	11.	11.	0.14		
ROUTED TO	S38	126.	13.00	35.	11.	11.	0.14	2.00	13.00
HYDROGRAPH AT	C38	25.	12.75	8.	2.	2.	0.03		
2 COMBINED AT	J@END	148.	13.00	42.	13.	13.	0.17		

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HEC1 S/N: 1343000043       HMVersion: 6.33    Data File: C:\WESTPT\THEX2IN.PRN

****************************************                                              ****************************************
*                                      *                                              *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                              *    U.S. ARMY CORPS OF ENGINEERS      *
*              MAY   1991              *                                              *    HYDROLOGIC ENGINEERING CENTER     *
*           VERSION 4.0.1E             *                                              *         609 SECOND STREET            *
*                                      *                                              *      DAVIS, CALIFORNIA 95616         *
* RUN DATE  08/20/1993  TIME  08:59:52 *                                              *          (916) 756-1104              *
*                                      *                                              *                                      *
****************************************                                              ****************************************



                         THOMPSON TRIB. TO MATTAPONI         EXISTING CONDITIONS
                         L&M JOB 92-093               2-YEAR STORM

   4 IO         OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN           5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1    0  ENDING DATE
                     NDTIME        2355  ENDING TIME
                      ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   23.92 HOURS

      ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH, ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE-FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C40	7.	13.50	4.	1.	1.	0.04		
HYDROGRAPH AT	C39	23.	12.92	8.	2.	2.	0.05		
2 COMBINED AT	J@S37	29.	13.00	12.	4.	4.	0.08		
ROUTED TO	S37	29.	13.17	12.	3.	3.	0.08	2.71	13.17
HYDROGRAPH AT	C37	7.	12.58	2.	1.	1.	0.02		
HYDROGRAPH AT	C36	9.	13.17	4.	1.	1.	0.03		
HYDROGRAPH AT	C35	8.	12.50	2.	1.	1.	0.01		
ROUTED TO	S36	7.	13.33	2.	1.	1.	0.01	1.88	13.33
4 COMBINED AT	J@S38	47.	13.25	19.	6.	6.	0.14		
ROUTED TO	S38	45.	13.92	19.	6.	6.	0.14	1.64	13.92
HYDROGRAPH AT	C38	5.	13.25	2.	1.	1.	0.03		
2 COMBINED AT	J@END	48.	13.92	20.	6.	6.	0.17		

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HEC1 S/N: 1343000043       HMVersion: 6.33    Data File: C:\WESTPT\THF2IN.PRN

****************************************                                             ****************************************
*                                      *                                             *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                             *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY   1991              *                                             *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E             *                                             *        609 SECOND STREET             *
*                                      *                                             *     DAVIS, CALIFORNIA 95616          *
*  RUN DATE  08/20/1993  TIME  08:58:13 *                                            *         (916) 756-1104               *
*                                      *                                             *                                      *
****************************************                                             ****************************************


                         THOMPSON TRIB. TO MATTAPONI          FUTURE CONDITIONS
                         L&M JOB 92-093              2-YEAR STORM

   4 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT        HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1    0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      1    0  ENDING DATE
                   NDTIME       2355  ENDING TIME
                    ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   23.92 HOURS

         ENGLISH UNITS
              DRAINAGE AREA          SQUARE MILES
              PRECIPITATION DEPTH    INCHES
              LENGTH, ELEVATION      FEET
              FLOW                   CUBIC FEET PER SECOND
              STORAGE VOLUME         ACRE-FEET
              SURFACE AREA           ACRES
              TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C40	19.	12.42	4.	1.	1.	0.04		
HYDROGRAPH AT	C39	31.	12.33	6.	2.	2.	0.05		
2 COMBINED AT	J@S37	48.	12.33	10.	3.	3.	0.08		
ROUTED TO	S37	46.	12.50	10.	3.	3.	0.08	2.91	12.50
HYDROGRAPH AT	C37	10.	12.50	2.	1.	1.	0.02		
HYDROGRAPH AT	C36	12.	12.92	4.	1.	1.	0.03		
HYDROGRAPH AT	C35	10.	12.42	2.	1.	1.	0.01		
ROUTED TO	S36	8.	13.17	2.	1.	1.	0.01	1.91	13.17
4 COMBINED AT	J@S38	65.	12.58	18.	5.	5.	0.14		
ROUTED TO	S38	57.	13.25	18.	5.	5.	0.14	1.72	13.25
HYDROGRAPH AT	C38	14.	12.75	4.	1.	1.	0.03		
2 COMBINED AT	J@END	66.	13.25	21.	6.	6.	0.17		

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HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\MGEX100N.PRN

****************************************                          ****************************************
*                                      *                          *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                          *   U.S. ARMY CORPS OF ENGINEERS       *
*             MAY   1991               *                          *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E             *                          *         609 SECOND STREET            *
*                                      *                          *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE  08/19/1993  TIME  16:41:54 *                          *          (916) 756-1104              *
*                                      *                          *                                      *
****************************************                          ****************************************


                         X     X  XXXXXXX   XXXXX          X
                         X     X  X        X     X        XX
                         X     X  X        X               X
                         XXXXXXX  XXXX     X       XXXXX   X
                         X     X  X        X               X
                         X     X  X        X     X         X
                         X     X  XXXXXXX   XXXXX         XXX


                      :::::::::::::::::::::::::::::::::::::::::::
                      :::::::::::::::::::::::::::::::::::::::::::
                      :::                                     :::
                      :::  Full Microcomputer Implementation  :::
                      :::                 by                  :::
                      :::        Haestad Methods, Inc.        :::
                      :::                                     :::
                      :::::::::::::::::::::::::::::::::::::::::::
                      :::::::::::::::::::::::::::::::::::::::::::

              37 Brookside Road * Waterbury, Connecticut  06708 * (203) 755-1666


THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID    MAGNOLIA TRIB. TO MATTAPONI          EXISTING CONDITIONS
   2          ID    L&M JOB 92-093       100-YEAR STORM
              *DIAGRAM
   3          IT       5                     288
   4          IO       5
              *
              *

   5          KK     C27
   6          BA   0.059
              * 2-YEAR STORM
              *                 0.47    0.95     1.6    1.81    2.02    2.55    3.03     3.5
              * 10-YEAR STORM
              *                  0.6    1.28    2.28    2.61    2.95     3.8    4.56    5.33
              * 25-YEAR STORM
              *                 0.68    1.49    2.63    3.08    3.49    4.53    5.45    6.38
              * 100-YEAR STORM
   7          PH                   0.81    1.81     3.3    3.82    4.33    5.65    6.83       8
   8          LS               78
   9          UD   1.206
              *  BAGBY   CULVERT AT BAGBY - R27
              *      1    ELEV       7
              *
              *
              *

  10          KK     S28
  11          RS       3    FLOW      -1
  12          RC   0.065   0.065   0.065    1410   0.006
  13          RX     214     222     239     240     242     243     260     294
  14          RY       8       6       6     2.5     2.5       6       6       8

  15          KK     C28
  16          BA   0.074
  17          LS               73
  18          UD    0.72

  19          KK   J@R28 COMBINE S28 AND C28
  20          HC       2

  21          KK  CHEL28   CULVERT AT CHELSEA - R28
  22          RS       1    ELEV       3
  23          SA       0    0.19    0.51    0.82    1.48    2.13    2.62    3.27     3.6
  24          SE    1.17       2       3       4       5       6    6.66    7.55    7.97
  25          SQ       0      11      24      37      52      67      74     200     400

  26          KK    S285
  27          RS       6    FLOW      -1
  28          RC    0.07    0.05    0.07    1690   0.004
  29          RX       0      30      32     125     135     210     214     230
              *        8       2       0    -0.5    -0.5    -0.2       2       8
  30          RY     8.5     2.5     0.5       0       0     0.3     2.5     8.5
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  31          KK    C285
  32          BA   0.055
  33          LS              66
  34          UD   0.786

  35          KK   J8END COMBINE S285 AND C285
  36          HC       2
  37          ZZ
```

```
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    5         C27
                V
                V
   10         S28
                .
                .
   15           .         C28
                .           .
                .           .
   19       J@R28............
                V
                V
   21      CHEL28
                V
                V
   26        S285
                .
                .
   31           .        C285
                .           .
                .           .
   35       J@END............

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\MGEX100N.PRN

*****************************************                   *****************************************
*                                       *                   *                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                   *    U.S. ARMY CORPS OF ENGINEERS      *
*              MAY   1991               *                   *    HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E              *                   *          609 SECOND STREET            *
*                                       *                   *       DAVIS, CALIFORNIA 95616         *
* RUN DATE  08/19/1993  TIME  16:41:54  *                   *           (916) 756-1104              *
*                                       *                   *                                       *
*****************************************                   *****************************************


                    MAGNOLIA TRIB. TO MATTAPONI          EXISTING CONDITIONS
                    L&M JOB 92-093       100-YEAR STORM

   4 IO         OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1   0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      1   0  ENDING DATE
                    NDTIME       2355  ENDING TIME
                     ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL    0.08 HOURS
                       TOTAL TIME BASE   23.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C27	62.	13.17	27.	8.	8.	0.06		
ROUTED TO	S28	61.	13.42	27.	8.	8.	0.06	6.64	13.42
HYDROGRAPH AT	C28	99.	12.75	30.	9.	9.	0.07		
2 COMBINED AT	J@R28	135.	12.92	57.	18.	18.	0.13		
ROUTED TO	CHEL28	101.	13.58	57.	18.	18.	0.13	6.85	13.58
ROUTED TO	S285	100.	13.83	57.	18.	18.	0.13	0.64	13.83
HYDROGRAPH AT	C285	58.	12.83	19.	6.	6.	0.05		
2 COMBINED AT	J@END	123.	13.75	75.	24.	24.	0.19		

*** NORMAL END OF HEC-1 ***

```
HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\MGF100IN.PRN

****************************************                                                      ****************************************
*                                      *                                                      *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                      *    U.S. ARMY CORPS OF ENGINEERS      *
*             MAY   1991               *                                                      *    HYDROLOGIC ENGINEERING CENTER     *
*          VERSION 4.0.1E              *                                                      *          609 SECOND STREET           *
*                                      *                                                      *       DAVIS, CALIFORNIA 95616        *
* RUN DATE  08/19/1993  TIME  16:41:24 *                                                      *           (916) 756-1104             *
*                                      *                                                      *                                      *
****************************************                                                      ****************************************



                            MAGNOLIA TRIB. TO MATTAPONI          FUTURE CONDITIONS
                            L&M JOB 92-093       100-YEAR STORM

  4 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     1    0  ENDING DATE
                     NDTIME       2355  ENDING TIME
                      ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   23.92 HOURS

      ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH, ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE-FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C27	117.	12.50	29.	9.	9.	0.06		
ROUTED TO	S28	113.	12.67	29.	9.	9.	0.06	7.06	12.67
HYDROGRAPH AT	C28	122.	12.58	32.	10.	10.	0.07		
2 COMBINED AT	J8R28	232.	12.58	61.	19.	19.	0.13		
ROUTED TO	CHEL28	167.	12.92	60.	19.	19.	0.13	7.31	12.92
ROUTED TO	S285	162.	13.25	60.	20.	20.	0.13	0.82	13.25
HYDROGRAPH AT	C285	83.	12.58	22.	7.	7.	0.05		
2 COMBINED AT	J8END	197.	13.17	82.	26.	26.	0.19		

```
HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\MGEX25IN.FRN

****************************************                        ****************************************
*                                      *                        *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                        *   U.S. ARMY CORPS OF ENGINEERS       *
*             MAY   1991               *                        *   HYDROLOGIC ENGINEERING CENTER      *
*          VERSION 4.0.1E              *                        *        609 SECOND STREET             *
*                                      *                        *     DAVIS, CALIFORNIA 95616          *
*  RUN DATE  08/20/1993  TIME  09:03:38 *                       *         (916) 756-1104               *
*                                      *                        *                                      *
****************************************                        ****************************************



                         MAGNOLIA TRIB. TO MATTAPONI          EXISTING CONDITIONS
                         L&M JOB 92-093       25-YEAR STORM

  4 IO         OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT         HYDROGRAPH TIME DATA
                      NMIN           5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1    0  STARTING DATE
                     ITIME        0000  STARTING TIME
                        NQ         288  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      1    0  ENDING DATE
                    NDTIME        2355  ENDING TIME
                     ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   23.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C27	46.	13.25	20.	6.	6.	0.06		
ROUTED TO	S28	45.	13.50	20.	6.	6.	0.06	6.46	13.50
HYDROGRAPH AT	C28	71.	12.75	22.	7.	7.	0.07		
2 COMBINED AT	J@R28	94.	12.83	41.	13.	13.	0.13		
ROUTED TO	CHEL28	67.	13.75	41.	13.	13.	0.13	5.98	13.75
ROUTED TO	S285	67.	14.00	41.	13.	13.	0.13	0.54	14.00
HYDROGRAPH AT	C285	39.	12.83	13.	4.	4.	0.05		
2 COMBINED AT	J@END	87.	13.08	54.	17.	17.	0.19		

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HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\MGF25IN.PRN

****************************************                                          ****************************************
*                                      *                                          *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                          *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY   1991              *                                          *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E             *                                          *          609 SECOND STREET           *
*                                      *                                          *       DAVIS, CALIFORNIA 95616        *
*  RUN DATE  08/20/1993  TIME  09:05:09 *                                         *          (916) 756-1104              *
*                                      *                                          *                                      *
****************************************                                          ****************************************




                              MAGNOLIA TRIB. TO MATTAPONI          FUTURE CONDITIONS
                              L&M JOB 92-093       25-YEAR STORM

   4 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1   0  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      1   0  ENDING DATE
                      NDTIME       2355  ENDING TIME
                       ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL    0.08 HOURS
                      TOTAL TIME BASE   23.92 HOURS

           ENGLISH UNITS
                DRAINAGE AREA         SQUARE MILES
                PRECIPITATION DEPTH   INCHES
                LENGTH, ELEVATION     FEET
                FLOW                  CUBIC FEET PER SECOND
                STORAGE VOLUME        ACRE-FEET
                SURFACE AREA          ACRES
                TEMPERATURE           DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C27	89.	12.50	22.	7.	7.	0.06		
ROUTED TO	S28	85.	12.67	22.	7.	7.	0.06	6.86	12.67
HYDROGRAPH AT	C28	89.	12.58	23.	7.	7.	0.07		
2 COMBINED AT	J@R28	171.	12.67	45.	14.	14.	0.13		
ROUTED TO	CHEL28	100.	13.08	45.	14.	14.	0.13	6.35	13.08
ROUTED TO	S285	97.	13.42	45.	15.	15.	0.13	0.63	13.42
HYDROGRAPH AT	C285	59.	12.58	15.	5.	5.	0.05		
2 COMBINED AT	J@END	117.	13.33	60.	19.	19.	0.19		

```
HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\MGEX10IN.PRN

**************************************                              **************************************
*                                    *                              *                                    *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                            *   U.S. ARMY CORPS OF ENGINEERS     *
*             MAY   1991             *                              *   HYDROLOGIC ENGINEERING CENTER    *
*           VERSION 4.0.1E           *                              *        609 SECOND STREET           *
*                                    *                              *     DAVIS, CALIFORNIA 95616        *
*  RUN DATE  06/20/1993  TIME  09:04:08 *                           *         (916) 756-1104             *
*                                    *                              *                                    *
**************************************                              **************************************


                          MAGNOLIA TRIB. TO MATTAPONI          EXISTING CONDITIONS
                          L&M JOB 92-093       10-YEAR STORM

  4 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1     0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     1     0  ENDING DATE
                     NDTIME        2355  ENDING TIME
                      ICENT          19  CENTURY MARK

               COMPUTATION INTERVAL    0.08 HOURS
                    TOTAL TIME BASE   23.92 HOURS

       ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH, ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE-FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C27	35.	13.25	15.	5.	5.	0.06		
ROUTED TO	S28	35.	13.50	15.	5.	5.	0.06	6.32	13.50
HYDROGRAPH AT	C28	54.	12.75	16.	5.	5.	0.07		
2 COMBINED AT	J@R28	74.	12.75	31.	10.	10.	0.13		
ROUTED TO	CHEL26	54.	13.67	31.	10.	10.	0.13	5.15	13.67
ROUTED TO	S265	54.	13.92	31.	10.	10.	0.13	0.50	13.92
HYDROGRAPH AT	C285	28.	12.83	9.	3.	3.	0.05		
2 COMBINED AT	J@END	69.	13.25	41.	13.	13.	0.19		

HEC1 S/N: 1343000043   HMVersion: 6.33   Data File: C:\WESTPT\MGF10IN.PRN

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****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY  1991               *                    *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E             *                    *        609 SECOND STREET             *
*                                      *                    *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE  08/20/1993  TIME  09:05:38 *                   *          (916) 756-1104              *
*                                      *                    *                                      *
****************************************                    ****************************************
```

```
                            MAGNOLIA TRIB. TO MATTAPONI          FUTURE CONDITIONS
                            L&M JOB 92-093       10-YEAR STORM

   4 IO         OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN           5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1    0  ENDING DATE
                     NDTIME        2355  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL    0.08 HOURS
                      TOTAL TIME BASE   23.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C27	71.	12.50	17.	5.	5.	0.06		
ROUTED TO	S26	67.	12.75	17.	5.	5.	0.06	6.70	12.75
HYDROGRAPH AT	C28	68.	12.58	17.	5.	5.	0.07		
2 COMBINED AT	J@R28	133.	12.67	35.	11.	11.	0.13		
ROUTED TO	CHEL28	69.	13.17	35.	11.	11.	0.13	6.20	13.17
ROUTED TO	S285	69.	13.50	34.	11.	11.	0.13	0.55	13.50
HYDROGRAPH AT	C285	44.	12.58	11.	3.	3.	0.05		
2 COMBINED AT	J@END	87.	13.00	46.	15.	15.	0.19		

HEC1 S/N: 1343000043 HMVersion: 6.33 Data File: C:\WESTPT\MGEX2IN.PRN

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****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              MAY   1991              *
*           VERSION 4.0.1E             *
*                                      *
*  RUN DATE  08/20/1993  TIME  09:04:38 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
                         MAGNOLIA TRIB. TO MATTAPONI        EXISTING CONDITIONS
                         L&M JOB 92-093      2-YEAR STORM

  4 IO         OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT         HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1   0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      1   0  ENDING DATE
                   NDTIME       2355  ENDING TIME
                   ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   23.92 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C27	18.	13.25	8.	2.	2.	0.06		
ROUTED TO	S28	18.	13.42	8.	2.	2.	0.06	5.77	13.42
HYDROGRAPH AT	C28	25.	12.75	8.	2.	2.	0.07		
2 COMBINED AT	J@R28	37.	13.00	15.	5.	5.	0.13		
ROUTED TO	CHEL28	31.	13.42	15.	5.	5.	0.13	3.34	13.42
ROUTED TO	S285	30.	14.08	15.	5.	5.	0.13	0.38	14.08
HYDROGRAPH AT	C285	11.	12.92	4.	1.	1.	0.05		
2 COMBINED AT	J@END	35.	14.00	19.	7.	7.	0.19		

```
HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\MGF2IN.PRN

****************************************                          ****************************************
*                                      *                          *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                          *   U.S. ARMY CORPS OF ENGINEERS       *
*             MAY   1991               *                          *   HYDROLOGIC ENGINEERING CENTER      *
*          VERSION 4.0.1E              *                          *        609 SECOND STREET             *
*                                      *                          *      DAVIS, CALIFORNIA 95616         *
* RUN DATE  08/20/1993  TIME  09:06:08 *                          *         (916) 756-1104               *
*                                      *                          *                                      *
****************************************                          ****************************************


                         MAGNOLIA TRIB. TO MATTAPONI         FUTURE CONDITIONS
                         L&M JOB 92-093       2-YEAR STORM

  4 IO         OUTPUT CONTROL VARIABLES
                    IPRNT           5  PRINT CONTROL
                    IPLOT           0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT         HYDROGRAPH TIME DATA
                     NMIN           5  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1     0  STARTING DATE
                    ITIME        0000  STARTING TIME
                       NQ         288  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     1     0  ENDING DATE
                   NDTIME        2355  ENDING TIME
                    ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   23.92 HOURS

      ENGLISH UNITS
          DRAINAGE AREA          SQUARE MILES
          PRECIPITATION DEPTH    INCHES
          LENGTH, ELEVATION      FEET
          FLOW                   CUBIC FEET PER SECOND
          STORAGE VOLUME         ACRE-FEET
          SURFACE AREA           ACRES
          TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C27	40.	12.50	9.	3.	3.	0.06		
ROUTED TO	S28	36.	12.83	9.	3.	3.	0.06	6.34	12.83
HYDROGRAPH AT	C28	34.	12.58	9.	3.	3.	0.07		
2 COMBINED AT	J@R28	67.	12.75	18.	5.	5.	0.13		
ROUTED TO	CHEL28	45.	13.17	18.	6.	6.	0.13	4.55	13.17
ROUTED TO	S265	45.	13.42	18.	6.	6.	0.13	0.46	13.42
HYDROGRAPH AT	C285	20.	12.58	5.	2.	2.	0.05		
2 COMBINED AT	J@END	53.	13.25	23.	8.	8.	0.19		

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HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\NCEX100N.PRN

****************************************                                                ****************************************
*                                      *                                                *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY   1991              *                                                *   HYDROLOGIC ENGINEERING CENTER      *
*            VERSION 4.0.1E            *                                                *         609 SECOND STREET            *
*                                      *                                                *      DAVIS, CALIFORNIA 95616         *
* RUN DATE  08/20/1993  TIME  08:36:16 *                                                *          (916) 756-1104              *
*                                      *                                                *                                      *
****************************************                                                ****************************************


                                          X     X  XXXXXXX   XXXXX           X
                                          X     X  X        X     X         XX
                                          X     X  X        X                X
                                          XXXXXXX  XXXX     X         XXXXX  X
                                          X     X  X        X                X
                                          X     X  X        X     X          X
                                          X     X  XXXXXXX   XXXXX          XXX


                                      :::::::::::::::::::::::::::::::::::::::::::
                                      :::::::::::::::::::::::::::::::::::::::::::
                                      :::                                     :::
                                      :::  Full Microcomputer Implementation  :::
                                      :::                 by                  :::
                                      :::         Haestad Methods, Inc.       :::
                                      :::                                     :::
                                      :::::::::::::::::::::::::::::::::::::::::::
                                      :::::::::::::::::::::::::::::::::::::::::::

                             37 Brookside Road * Waterbury, Connecticut  06708 * (203) 755-1666


        THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

        THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
        THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
        NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
        DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
        KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID   NORTH CHELSEA TRIB. TO MATTAPONI     EXISTING CONDITIONS
   2          ID   L&M JOB 92-093               100-YEAR STORM
              *DIAGRAM
   3          IT      5                  288
   4          IO      5
              *
              *

   5          KK     C29
   6          BA   0.039
              * 2-YEAR STORM
              *                 0.47    0.95     1.6    1.81    2.02    2.55    3.03     3.5
              * 10-YEAR STORM
              *                  0.6    1.28    2.28    2.61    2.95     3.8    4.56    5.33
              * 25-YEAR STORM
              *                 0.68    1.49    2.68    3.08    3.49    4.53    5.45    6.38
              * 100-YEAR STORM
   7          PH                  0.81    1.81     3.3    3.82    4.33    5.65    6.83       8
   8          LS              69
   9          UD   0.672

  10          KK     C30
  11          BA   0.047
  12          LS              71
  13          UD   1.008
              *    R30   CULVERT AT CHELSEA - R30
              *      1    ELEV       ?
              *
              *
              *

  14          KK   JBS31 COMBINE C29 AND R30
  15          HC       2

  16          KK     S31
  17          RS       3    FLOW      -1
  18          RC    0.09    0.05    0.09    2020   0.005
  19          RX      90     130     146     160     172     186     210     260
  20          RY      10       8       6       4       4       6       8      10

  21          KK     C34
  22          BA   0.433
  23          LS              67
  24          UD   1.314

  25          KK     C31
  26          BA   0.031
  27          LS              64
  28          UD   0.756
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 29           KK    C33
 30           BA   0.05
 31           LS              52
 32           UD   1.08

 33           KK  J@R33 COMBINE C34, S31, C31, AND C33
 34           HC      4

 35           KK    R33   CULVERT AT CHELSEA - R33
 36           RS      1    ELEV       3
 37           SA   7.44    9.42   11.39   11.87   12.29   12.61    13.3
 38           SE      2       3       4    4.25    4.47    4.64       5
 39           SQ     37      47     100     300     400     500     700

 40           KK    S32
 41           RS      5    FLOW      -1
 42           RC   0.07    0.04    0.07    2890   0.005
 43           RX     40      90     120     300     320     350     372     380
 44           RY      4       2     1.1       1       1     1.1       2       4

 45           KK    C32
 46           BA  0.063
 47           LS              68
 48           UD  1.014

 49           KK  J@END COMBINE S32 AND C32
 50           HC      2
 51           ZZ
```

```
              SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING         (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR       (<---) RETURN OF DIVERTED OR PUMPED FLOW

    5        C29
              .
              .
   10         .         C30
              .          .
              .          .
   14      J@S31............
              V
              V
   16        S31
              .
              .
   21         .         C34
              .          .
              .          .
   25         .          .         C31
              .          .          .
              .          .          .
   29         .          .          .         C33
              .          .          .          .
              .          .          .          .
   33      J@R33........................................
              V
              V
   35        R33
              V
              V
   40        S32
              .
              .
   45         .         C32
              .          .
              .          .
   49      J@END............

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\NCEX100N.PRN

****************************************                                                              ****************************************
*                                      *                                                              *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                              *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY   1991              *                                                              *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E             *                                                              *         609 SECOND STREET            *
*                                      *                                                              *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE  08/20/1993  TIME  08:36:16 *                                                             *          (916) 756-1104              *
*                                      *                                                              *                                      *
****************************************                                                              ****************************************


                              NORTH CHELSEA TRIB. TO MATTAPONI     EXISTING CONDITIONS
                              L&M JOB 92-093               100-YEAR STORM

  4 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     1    0  ENDING DATE
                     NDTIME       2355  ENDING TIME
                     ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   23.92 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C29	49.	12.67	15.	5.	5.	0.04		
HYDROGRAPH AT	C30	48.	13.00	18.	6.	6.	0.05		
2 COMBINED AT	J@S31	92.	12.83	33.	10.	10.	0.09		
ROUTED TO	S31	91.	13.00	33.	10.	10.	0.09	5.67	13.00
HYDROGRAPH AT	C34	324.	13.33	151.	47.	47.	0.43		
HYDROGRAPH AT	C31	31.	12.75	10.	3.	3.	0.03		
HYDROGRAPH AT	C33	24.	13.17	10.	3.	3.	0.05		
4 COMBINED AT	J@R33	449.	13.17	204.	63.	63.	0.60		
ROUTED TO	R33	390.	13.67	177.	77.	77.	0.60	4.45	13.67
ROUTED TO	S32	386.	14.00	176.	77.	77.	0.60	1.20	14.00
HYDROGRAPH AT	C32	59.	13.00	23.	7.	7.	0.06		
2 COMBINED AT	J@END	417.	13.92	193.	84.	84.	0.66		

*** NORMAL END OF HEC-1 ***

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HEC1 S/N: 1343000043       HMVersion: 6.33    Data File: C:\WESTPT\NCF100IN.PRN

 ****************************************                                                 ****************************************
 *                                      *                                                 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                 *  U.S. ARMY CORPS OF ENGINEERS        *
 *             MAY   1991               *                                                 *  HYDROLOGIC ENGINEERING CENTER       *
 *          VERSION 4.0.1E              *                                                 *       609 SECOND STREET              *
 *                                      *                                                 *    DAVIS, CALIFORNIA 95616           *
 * RUN DATE  08/20/1993  TIME  08:36:49 *                                                 *       (916) 756-1104                 *
 *                                      *                                                 *                                      *
 ****************************************                                                 ****************************************



                            NORTH CHELSEA TRIB. TO MATTAPONI     FUTURE CONDITIONS
                            L&M JOB 92-093               100-YEAR STORM

   4 IO         OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN           5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1    0  ENDING DATE
                     NDTIME        2355  ENDING TIME
                      ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   23.92 HOURS

         ENGLISH UNITS
              DRAINAGE AREA         SQUARE MILES
              PRECIPITATION DEPTH   INCHES
              LENGTH, ELEVATION     FEET
              FLOW                  CUBIC FEET PER SECOND
              STORAGE VOLUME        ACRE-FEET
              SURFACE AREA          ACRES
              TEMPERATURE           DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C29	73.	12.50	18.	6.	6.	0.04		
HYDROGRAPH AT	C30	100.	12.25	19.	6.	6.	0.05		
2 COMBINED AT	J@S31	163.	12.33	37.	12.	12.	0.09		
ROUTED TO	S31	157.	12.50	37.	12.	12.	0.09	6.15	12.50
HYDROGRAPH AT	C34	543.	12.92	196.	62.	62.	0.43		
HYDROGRAPH AT	C31	57.	12.58	16.	5.	5.	0.03		
HYDROGRAPH AT	C33	65.	12.83	21.	7.	7.	0.05		
4 COMBINED AT	J@R33	764.	12.83	271.	85.	85.	0.60		
ROUTED TO	R33	672.	13.08	248.	96.	96.	0.60	4.95	13.08
ROUTED TO	S32	666.	13.33	246.	96.	96.	0.60	2.08	13.33
HYDROGRAPH AT	C32	81.	12.92	29.	9.	9.	0.06		
2 COMBINED AT	J@END	730.	13.33	271.	105.	105.	0.66		

HEC1 S/N: 1343000043   HMVersion: 6.33   Data File: C:\WESTPT\NCEX25IN.PRN

```
****************************************
*                                      *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            MAY  1991                 *
*          VERSION 4.0.1E              *
*                                      *
* RUN DATE  08/20/1993  TIME  09:00:25 *
*                                      *
****************************************
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```
****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*        609 SECOND STREET             *
*      DAVIS, CALIFORNIA 95616         *
*         (916) 756-1104               *
*                                      *
****************************************
```

```
                         NORTH CHELSEA TRIB. TO MATTAPONI     EXISTING CONDITIONS
                         L&M JOB 92-093               25-YEAR STORM

  4 IO        OUTPUT CONTROL VARIABLES
                   IPRNT          5  PRINT CONTROL
                   IPLOT          0  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                    NMIN          5  MINUTES IN COMPUTATION INTERVAL
                   IDATE     1    0  STARTING DATE
                   ITIME       0000  STARTING TIME
                      NO        288  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE     1    0  ENDING DATE
                  NDTIME       2355  ENDING TIME
                   ICENT         19  CENTURY MARK

               COMPUTATION INTERVAL    0.08 HOURS
                    TOTAL TIME BASE   23.92 HOURS

       ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH, ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE-FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C29	34.	12.67	10.	3.	3.	0.04		
HYDROGRAPH AT	C30	34.	13.00	13.	4.	4.	0.05		
2 COMBINED AT	J@S31	65.	12.83	23.	7.	7.	0.09		
ROUTED TO	S31	63.	13.00	23.	7.	7.	0.09	5.40	13.00
HYDROGRAPH AT	C34	221.	13.42	104.	32.	32.	0.43		
HYDROGRAPH AT	C31	21.	12.75	7.	2.	2.	0.03		
HYDROGRAPH AT	C33	13.	13.25	6.	2.	2.	0.03		
4 COMBINED AT	J@R33	304.	13.25	140.	43.	43.	0.60		
ROUTED TO	R33	239.	13.92	116.	60.	60.	0.60	4.17	13.92
ROUTED TO	S32	230.	14.25	116.	60.	60.	0.60	1.60	14.25
HYDROGRAPH AT	C32	40.	13.08	16.	5.	5.	0.06		
2 COMBINED AT	J@END	246.	14.25	126.	65.	65.	0.66		

HEC1 S/N: 1343000043   HMVersion: 6.33   Data File: C:\WESTPT\NCF25IN.PRN

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****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             MAY   1991               *
*           VERSION 4.0.1E             *
*                                      *
* RUN DATE  08/20/1993  TIME  09:02:02 *
*                                      *
****************************************

****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*        609 SECOND STREET             *
*     DAVIS, CALIFORNIA 95616          *
*         (916) 756-1104               *
*                                      *
****************************************
```

NORTH CHELSEA TRIB. TO MATTAPONI   FUTURE CONDITIONS
L&M JOB 92-093   25-YEAR STORM

```
  4 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                    NMIN           5  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1    0  STARTING DATE
                    ITIME       0000  STARTING TIME
```

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            NQ          288  NUMBER OF HYDROGRAPH ORDINATES
        NDDATE      1    0  ENDING DATE
        NDTIME        2355  ENDING TIME
         ICENT          19  CENTURY MARK

     COMPUTATION INTERVAL    0.08 HOURS
          TOTAL TIME BASE   23.92 HOURS

ENGLISH UNITS
     DRAINAGE AREA         SQUARE MILES
     PRECIPITATION DEPTH   INCHES
     LENGTH, ELEVATION     FEET
     FLOW                  CUBIC FEET PER SECOND
     STORAGE VOLUME        ACRE-FEET
     SURFACE AREA          ACRES
     TEMPERATURE           DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C29	55.	12.50	14.	4.	4.	0.04		
HYDROGRAPH AT	C30	72.	12.25	13.	4.	4.	0.05		
2 COMBINED AT	J@S31	119.	12.33	27.	8.	8.	0.09		
ROUTED TO	S31	112.	12.58	27.	8.	8.	0.09	5.86	12.58
HYDROGRAPH AT	C34	402.	12.92	144.	45.	45.	0.43		
HYDROGRAPH AT	C31	44.	12.58	12.	4.	4.	0.03		
HYDROGRAPH AT	C33	48.	12.83	15.	5.	5.	0.05		
4 COMBINED AT	J@R33	569.	12.83	199.	62.	62.	0.60		
ROUTED TO	R33	469.	13.25	175.	75.	75.	0.60	4.59	13.25
ROUTED TO	S32	460.	13.50	174.	75.	75.	0.60	1.88	13.50
HYDROGRAPH AT	C32	60.	12.92	21.	7.	7.	0.06		
2 COMBINED AT	J@END	503.	13.42	191.	82.	82.	0.66		

HEC1 S/N: 1343000043   HMVersion: 6.33   Data File: C:\WEBTPT\NCEX10IN.PRN

```
*************************************************          *************************************************
*                                               *          *                                               *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)           *          *   U.S. ARMY CORPS OF ENGINEERS                *
*              MAY  1991                        *          *   HYDROLOGIC ENGINEERING CENTER               *
*           VERSION 4.0.1E                      *          *         609 SECOND STREET                     *
*                                               *          *       DAVIS, CALIFORNIA 95616                 *
* RUN DATE  08/20/1993  TIME  09:00:58          *          *          (916) 756-1104                       *
*                                               *          *                                               *
*************************************************          *************************************************
```

```
                    NORTH CHELSEA TRIB. TO MATTAPONI     EXISTING CONDITIONS
                    L&M JOB 92-093               10-YEAR STORM

  4 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1    0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     1    0  ENDING DATE
                   NDTIME       2355  ENDING TIME
                    ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   23.92 HOURS

       ENGLISH UNITS
            DRAINAGE AREA          SQUARE MILES
            PRECIPITATION DEPTH    INCHES
            LENGTH, ELEVATION      FEET
            FLOW                   CUBIC FEET PER SECOND
            STORAGE VOLUME         ACRE-FEET
            SURFACE AREA           ACRES
            TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C29	25.	12.67	8.	2.	2.	0.04		
HYDROGRAPH AT	C30	25.	13.08	10.	3.	3.	0.05		
2 COMBINED AT	J@S31	46.	12.83	17.	5.	5.	0.09		
ROUTED TO	S31	46.	13.08	17.	5.	5.	0.09	5.19	13.08
HYDROGRAPH AT	C34	158.	13.42	75.	23.	23.	0.43		
HYDROGRAPH AT	C31	15.	12.83	5.	1.	1.	0.03		
HYDROGRAPH AT	C33	8.	13.25	4.	1.	1.	0.05		
4 COMBINED AT	J@R33	217.	13.25	101.	31.	31.	0.60		
ROUTED TO	R33	101.	14.92	80.	50.	50.	0.60	4.00	14.92
ROUTED TO	S32	100.	15.33	80.	50.	50.	0.60	1.38	15.33
HYDROGRAPH AT	C32	29.	13.08	12.	4.	4.	0.06		
2 COMBINED AT	J@END	109.	15.25	87.	53.	53.	0.66		

HEC1 S/N: 1343000043   HMVersion: 6.33   Data File: C:\WESTPT\NCF10IN.PRN

```
*****************************************                    *****************************************
*                                       *                    *                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *   U.S. ARMY CORPS OF ENGINEERS        *
*              MAY  1991                *                    *   HYDROLOGIC ENGINEERING CENTER       *
*           VERSION 4.0.1E              *                    *          609 SECOND STREET            *
*                                       *                    *       DAVIS, CALIFORNIA 95616         *
*  RUN DATE  08/20/1993  TIME  09:02:34 *                    *           (916) 756-1104              *
*                                       *                    *                                       *
*****************************************                    *****************************************
```

```
                         NORTH CHELSEA TRIB. TO MATTAPONI     FUTURE CONDITIONS
                         L&M JOB 92-093               10-YEAR STORM

  4 IO         OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT         HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE     1    0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE     1    0  ENDING DATE
                    NDTIME       2355  ENDING TIME
                     ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   23.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C29	43.	12.50	11.	3.	3.	0.04		
HYDROGRAPH AT	C30	54.	12.33	10.	3.	3.	0.05		
2 COMBINED AT	J@S31	91.	12.33	21.	6.	6.	0.09		
ROUTED TO	S31	86.	12.58	21.	6.	6.	0.09	5.63	12.58
HYDROGRAPH AT	C34	311.	12.92	111.	34.	34.	0.43		
HYDROGRAPH AT	C31	35.	12.58	9.	3.	3.	0.03		
HYDROGRAPH AT	C33	36.	12.83	12.	4.	4.	0.05		
4 COMBINED AT	J@R33	442.	12.83	153.	47.	47.	0.60		
ROUTED TO	R33	335.	13.33	130.	63.	63.	0.60	4.33	13.33
ROUTED TO	S32	327.	13.58	130.	63.	63.	0.60	1.72	13.58
HYDROGRAPH AT	C32	46.	12.92	16.	5.	5.	0.06		
2 COMBINED AT	J@END	355.	13.58	143.	68.	68.	0.66		

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HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\NCEX2IN.PRN

****************************************                                                     ****************************************
*                                      *                                                     *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                     *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY   1991              *                                                     *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E             *                                                     *         609 SECOND STREET            *
*                                      *                                                     *      DAVIS, CALIFORNIA 95616         *
* RUN DATE  08/20/1993  TIME  09:01:30 *                                                     *         (916) 756-1104               *
*                                      *                                                     *                                      *
****************************************                                                     ****************************************



                              NORTH CHELSEA TRIB. TO MATTAPONI     EXISTING CONDITIONS
                              L&M JOB 92-093               2-YEAR STORM

   4 IO         OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     1    0  ENDING DATE
                     NDTIME       2355  ENDING TIME
                     ICENT          19  CENTURY MARK

                COMPUTATION INTERVAL    0.08 HOURS
                     TOTAL TIME BASE   23.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C29	11.	12.75	3.	1.	1.	0.04		
HYDROGRAPH AT	C30	11.	13.08	4.	1.	1.	0.05		
2 COMBINED AT	J@S31	20.	12.92	8.	2.	2.	0.09		
ROUTED TO	S31	20.	13.17	8.	2.	2.	0.09	4.75	13.17
HYDROGRAPH AT	C34	62.	13.50	31.	10.	10.	0.43		
HYDROGRAPH AT	C31	5.	12.83	2.	1.	1.	0.03		
HYDROGRAPH AT	C33	1.	13.58	1.	0.	0.	0.05		
4 COMBINED AT	J@R33	84.	13.33	41.	13.	13.	0.60		
ROUTED TO	R33	47.	0.08	40.	38.	38.	0.60	3.00	0.00
ROUTED TO	S32	47.	0.08	40.	39.	39.	0.60	1.25	0.00
HYDROGRAPH AT	C32	12.	13.08	5.	1.	1.	0.06		
2 COMBINED AT	J@END	49.	13.17	45.	40.	40.	0.66		

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HEC1 S/N: 1343000043        HMVersion: 6.33    Data File: C:\WESTPT\NCF2IN.PRN

****************************************                                        ****************************************
*                                      *                                        *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                        *   U.S. ARMY CORPS OF ENGINEERS       *
*              MAY   1991              *                                        *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.0.1E             *                                        *        609 SECOND STREET             *
*                                      *                                        *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE  08/20/1993  TIME  09:03:06 *                                       *          (916) 756-1104              *
*                                      *                                        *                                      *
****************************************                                        ****************************************


                          NORTH CHELSEA TRIB. TO MATTAPONI     FUTURE CONDITIONS
                          L&M JOB 92-093               2-YEAR STORM

   4 IO         OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

     IT         HYDROGRAPH TIME DATA
                       NMIN           5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         288  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1    0  ENDING DATE
                     NDTIME        2355  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL    0.08 HOURS
                      TOTAL TIME BASE   23.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT
```
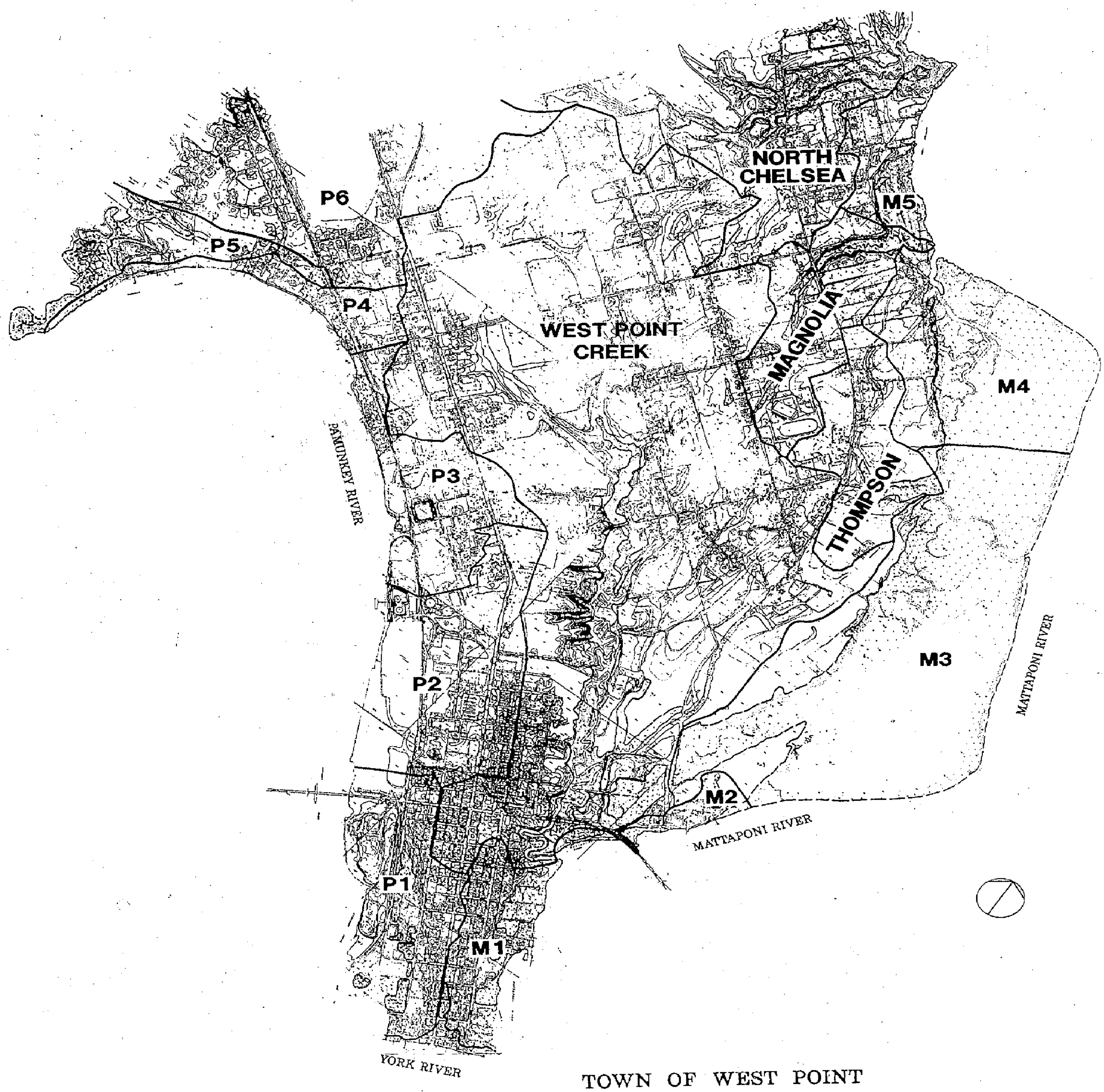

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	C29	24.	12.50	6.	2.	2.	0.04		
HYDROGRAPH AT	C30	26.	12.33	5.	1.	1.	0.05		
2 COMBINED AT	J@S31	46.	12.42	10.	3.	3.	0.09		
ROUTED TO	S31	42.	12.67	10.	3.	3.	0.09	5.14	12.67
HYDROGRAPH AT	C34	161.	13.00	57.	17.	17.	0.43		
HYDROGRAPH AT	C31	21.	12.58	5.	2.	2.	0.03		
HYDROGRAPH AT	C33	18.	12.83	6.	2.	2.	0.05		
4 COMBINED AT	J@R33	230.	12.83	79.	24.	24.	0.60		
ROUTED TO	R33	83.	14.17	64.	45.	45.	0.60	3.69	14.17
ROUTED TO	S32	83.	14.58	64.	45.	45.	0.60	1.34	14.58
HYDROGRAPH AT	C32	24.	12.92	8.	2.	2.	0.06		
2 COMBINED AT	J@END	91.	14.42	71.	47.	47.	0.66		

APPENDIX 3
WATER QUALITY CALCULATIONS



TOWN OF WEST POINT

COMPREHENSIVE DRAINAGE STUDY AND
STORMWATER MANAGEMENT PROGRAM

WEST POINT WATER QUALITY DATA

:ST POINT CREEK WATERSHED

EXISTING LAND USE

B.AREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
C1	49.68		0.25	B	12.61				0.75	9.46	
			0.25	B	2.69				0.75	2.02	
	39.54		HC	B	17.27				1.9	32.81	
			HC	C	2.05				1.9	3.90	
			HC	B	0.94				1.9	1.79	
			0.3	B	0.82				0.64	0.52	
			0.3	C	3.16				0.64	2.02	
		(9.96)	U	D	0				0.19	0.00	
		(.49)	U	B	0				0.08	0.00	1.33
C2	42.59		0.3	C	2.93				0.64	1.88	
			HC	D	0.49				1.9	0.93	
	23		HC	B	1.72				1.9	3.27	
		(2.04)	U	C	0				0.12	0.00	
		(4.31)	U	D	0				0.19	0.00	
		(26.7)	U	D	16.87				0.19	3.21	
			LI	D	0.99				1.48	1.47	0.47
C3	60.77		0.3	C	21.98				0.64	14.07	
		(14.66)	U	C	4.85				0.12	0.58	
	30.22	(13.56)	U	D	0				0.19	0.00	
		(6.30)	U	B	0				0.08	0.00	
			1.9	B	1.27				0.33	0.42	
			LI	C	2.12				1.48	3.14	0.60
C4	47.4		0.5	C	0.49				0.54	0.26.	
			LI	C	1.11				1.48	1.64	
	37.25		A	B	3.49				1.63	5.69	
			CEM	C	2.26				1.06	2.40	
			U	C	22.44				0.12	2.69	
		(9)	U	D	1.36				0.19	0.26	
		(7.39)	U	B	6.1				0.08	0.49	0.36
C5	33.47		CEM	C	3.17				1.06	3.36	
			CEM	C	2.53				1.06	2.68	
	22.66		U	C	7.25				0.12	0.87	
		(4.2)	U	D	0				0.19	0.00	
		(4.39)	U	B	0				0.08	0.00	

WEST POINT WATER QUALITY DATA

ST POINT CREEK WATERSHED — EXISTING LAND USE

SAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
			0.8	C	1.87				0.47	0.88	
			0.8	C	1.48				0.47	0.70	
			0.8	B	1.05				0.47	0.49	
			0.8	D	1.89				0.47	0.89	
			U	D	1.89				0.19	0.36	
			U	B	0.98				0.08	0.08	
			A	D	0.55				3.71	2.04	0.54
C6	53.07		A	C	3.11				2.42	7.53	
			0.8	C	14.13				0.47	6.64	
	42.16		0.8	D	0.87				0.47	0.41	
			U	C	6.23				0.12	0.75	
		(6.53)	U	D	2.1				0.19	0.40	
			U	B	1				0.08	0.08	
			U	B	2.32				0.08	0.19	
		(4.19)	U	B	0				0.08	0.00	
			A	B	0.82				1.63	1.34	
			U	C	3.11				0.12	0.37	
			U	B	3.4				0.08	0.27	
			0.8	B	0.59				0.47	0.28	
			0.8	C	1.39				0.47	0.65	
			0.8	B	2.22				0.47	1.04	
			0.8	D	0.87				0.47	0.41	0.48
C7	54.06		1	C	5.64				0.43	2.43	
			A	C	5.83				2.42	14.11	
	53.05		A	D	2.57				3.71	9.53	
			U	C	8.06				0.12	0.97	
			HC	C	10.72				1.9	20.37	
			U	B	10.9				0.08	0.87	
			A	B	7.72				1.63	12.58	
			U	D	0.43				0.19	0.08	
			U	B	1.02				0.08	0.08	
			A	B	0.96				1.63	1.56	1.16
C8	83.6		LI	C	3.45				1.48	5.11	
			U	D	6.52				0.19	1.24	
	75.05		APT	D	3.01				1.17	3.52	

WEST POINT WATER QUALITY DATA

:ST POINT CREEK WATERSHED

EXISTING LAND USE

B.AREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
			LI	C	0.86				1.48	1.27	
			0.4	C	10.67				0.6	6.40	
			0.4	C	4.43				0.6	2.66	
			U	D	4.58				0.19	0.87	
			U	D	3.26				0.19	0.62	
			APT	C	1.14				1.17	1.33	
			0.5	C	2.43				0.54	1.31	
			HC	C	2.22				1.9	4.22	
			1	C	7.65				0.43	3.29	
			LI	C	1.11				1.48	1.64	
			F	C	1.43				0.12	0.17	
			F	D	1.19				0.19	0.23	
			HC	C	1.64				1.9	3.12	
			U	D	3.87				0.19	0.74	
			LC	D	2.03				1.59	3.23	
			U	B	10.38				0.08	0.83	
			A	B	3.3				1.63	5.38	
			LI	C	0.68				1.48	1.01	0.64
C9	38.51		0.4	C	6.68				0.6	4.01	
			0.4	D	0.45				0.6	0.27	
	35.3		LC	C	0.26				1.59	0.41	
			U	C	1.06				0.12	0.13	
			U	D	21.09				0.19	4.01	
			A	D	0.91				3.71	3.38	
			U	C	0.64				0.12	0.08	
			U	B	2.82				0.08	0.23	
			A	B	0.23				1.63	0.37	
			U	C	1.16				0.12	0.14	0.37
C10	64.26		U	C	1.58				0.12	0.19	
			LC	C	8.94				1.59	14.21	
	60.74		0.9	C	1.14				0.45	0.51	
			0.4	C	1.08				0.6	0.65	
			LC	D	0.68				1.59	1.08	
			A	D	0.65				3.71	2.41	
			U	D	8.46				0.19	1.61	
			U	C	4.68				0.12	0.56	

WEST POINT WATER QUALITY DATA

ST POINT CREEK WATERSHED

EXISTING LAND USE

SAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
			U	B	0.74				0.08	0.06	
			A	D	3.49				3.71	12.95	
			A	C	3.25				2.42	7.87	
			U	A	3.71				0.04	0.15	
			U	C	8.21				0.12	0.99	
			U	B	5.57				0.08	0.45	
			A	B	1.69				1.63	2.75	
			A	A	0.66				0.83	0.55	
			0.6	A	0.42				0.52	0.22	
			1.1	A	0.47				0.43	0.20	
			A	C	0.72				2.42	1.74	
			0.6	C	0.79				0.52	0.41	
			A	C	0.48				2.42	1.16	
			A	B	0.41				1.63	0.67	
			1.1	D	0.38				0.43	0.16	
			A	D	0.85				3.71	3.15	
			A	B	1.69				1.63	2.75	0.95
C11	107.58		TH	D	2.17				0.92	2.00	
			U	C	1.34				0.12	0.16	
	107.62		A	C	2.76				2.42	6.68	
			A	D	1.68				3.71	6.23	
			LC	D	1.1				1.59	1.75	
			U	D	41.43				0.19	7.87	
			U	C	41.83				0.12	5.02	
			U	C	5.21				0.12	0.63	
			U	B	1.54				0.08	0.12	
			U	A	8.56				0.04	0.34	0.29
C12	60.48		A	C	0.48				2.42	1.16	
			A	D	1.39				3.71	5.16	
	58.34		A	B	0.6				1.63	0.98	
			A	D	0.73				3.71	2.71	
			A	B	1.18				1.63	1.92	
			0.7	B	3.22				0.49	1.58	
			0.7	D	2.2				0.49	1.08	
			0.7	C	0.52				0.49	0.25	
			A	B	1.58				1.63	2.58	

WEST POINT WATER QUALITY DATA

ST POINT CREEK WATERSHED

EXISTING LAND USE

3AREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
			U	B	7.44				0.08	0.60	
			U	C	2.96				0.12	0.36	
			1.1	A	0.54				0.43	0.23	
			1.1	C	0.91				0.43	0.39	
			0.6	B	1.41				0.52	0.73	
			1	D	0.54				0.43	0.23	
			1	B	0.36				0.43	0.15	
			1	B	0.44				0.43	0.19	
			0.8	D	0.87				0.47	0.41	
			A	D	1.59				3.71	5.90	
			A	D	1.07				3.71	3.97	
			U	D	13.43				0.19	2.55	
			U	C	2.45				0.12	0.29	
			U	C	7.17				0.12	0.86	
			A	D	2.32				3.71	8.61	
			A	B	1.04				1.63	1.70	
			U	B	2.39				0.08	0.19	
			U	D	1.38				0.19	0.26	0.75
C13	39.05		U	B	1.43				0.08	0.11	
			A	B	6.1				1.63	9.94	
	36.18		A	D	0.95				3.71	3.52	
			A	B	0.75				1.63	1.22	
			A	B	2.64				1.63	4.30	
			A	B	1.52				1.63	2.48	
			U	D	0.72				0.19	0.14	
			0.5	C	0.49				0.54	0.26	
			U	D	2.26				0.19	0.43	
			U	B	5.93				0.08	0.47	
			U	B	1.84				0.08	0.15	
			0.9	B	1.59				0.45	0.72	
			U	B	1.96				0.08	0.16	
			A	B	2.1				1.63	3.42	
			0.7	B	0.79				0.49	0.39	
			A	B	3.72				1.63	6.06	
			U	B	1.39				0.08	0.11	0.94
C14	28.77		A	B	2.16				1.63	3.52	

WEST POINT WATER QUALITY DATA

ST POINT CREEK WATERSHED

EXISTING LAND USE

BAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
			U	B	1.74				0.08	0.14	
	27.82		A	D	5.63				3.71	20.89	
			U	B	11.75				0.08	0.94	
			A	B	3.84				1.63	6.26	
			U	D	1.34				0.19	0.25	
			0.5	C	0.71				0.54	0.38	
			U	D	0.65				0.19	0.12	1.17
C 15	42.16		U	B	0.36				0.08	0.03	
			U	D	2.49				0.19	0.47	
	40.85		U	C	11.4				0.12	1.37	
			2.8	B	0.69				0.31	0.21	
			A	B	2.63				1.63	4.29	
			0.7	B	2.4				0.49	1.18	
			A	C	4.76				2.42	11.52	
			A	D	1.7				3.71	6.31	
			A	B	2.1				1.63	3.42	
			A	B	5.18				1.63	8.44	
			A	C	3.18				2.42	7.70	
			A	C	3.96				2.42	9.58	1.33
C 16	32.22		0.5	C	3.17				0.54	1.71	
			0.5	C	0.62				0.54	0.33	
	31.33		0.5	D	0.55				0.54	0.30	
			0.5	D	1.47				0.54	0.79	
			0.5	C	1.71				0.54	0.92	
			A	B	0.34				1.63	0.55	
			A	D	1.41				3.71	5.23	
			U	D	1.07				0.19	0.20	
			0.5	D	1.22				0.54	0.66	
			0.5	B	2.52				0.54	1.36	
			A	C	0.55				2.42	1.33	
			0.5	C	0.39				0.54	0.21	
			0.5	D	1.74				0.54	0.94	
			0.5	D	3.04				0.54	1.64	
			A	C	0.69				2.42	1.67	
			A	D	2.22				3.71	8.24	
			A	C	2.78				2.42	6.73	

WEST POINT WATER QUALITY DATA

[POINT CREEK WATERSHED — EXISTING LAND USE

.REA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
			U	D	1.75				0.19	0.33	
			U	B	2.29				0.08	0.18	
			U	C	0.38				0.12	0.05	
			U	D	0.67				0.19	0.13	
			U	C	0.25				0.12	0.03	
			A	B	0.5				1.63	0.82	1.10
C 17	13.56		U	C	0.36				0.12	0.04	
			A	B	1.09				1.63	1.78	
	12.6		U	B	0.35				0.08	0.03	
			U	D	1.11				0.19	0.21	
			A	B	0.98				1.63	1.60	
			U	B	1.24				0.08	0.10	
			0.5	B	1.23				0.54	0.66	
			0.5	D	2.21				0.54	1.19	
			0.5	B	4.03				0.54	2.18	0.62
C 18	21.59		U	B	5.4				0.08	0.43	
			A	B	2.69				1.63	4.38	
	19.38		0.6	C	1.97				0.52	1.02	
			A	C	1.78				2.42	4.31	
		(.46)	U	D	0				0.19	0.00	
			A	D	0.66				3.71	2.45	
			A	B	0.66				1.63	1.08	
		(.47)	U	D	0				0.19	0.00	
		(.98)	U	B	0.58				0.08	0.05	
			U	C	2.28				0.12	0.27	
			0.7	B	0.73				0.49	0.36	
			0.7	C	1.7				0.49	0.83	
			0.7	C	0.93				0.49	0.46	0.81
C 19	26.96		0.5	C	2.39				0.54	1.29	
			A	D	0.47				3.71	1.74	
	25.07		A	C	2.36				2.42	5.71	
			A	D	2.26				3.71	8.38	
			A	C	4.95				2.42	11.98	
			U	C	1.71				0.12	0.21	
			U	C	0.88				0.12	0.11	

WEST POINT WATER QUALITY DATA

ST POINT CREEK WATERSHED — EXISTING LAND USE

AREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
			U	B	2.52				0.08	0.20	
			U	D	0.87				0.19	0.17	
			1	D	2.75				0.43	1.18	
			U	D	1.11				0.19	0.21	
			0.7	D	1.14				0.49	0.56	
			1	C	2.46				0.43	1.06	1.27
C20	20.25		U	C	1				0.12	0.12	
		(19)	U	D	14.37				0.19	2.73	0.19
C21	68.64	(4.1)	U	D	0.9				0.19	0.17	
			U	C	14.82				0.12	1.78	
	65.09		U	D	1.21				0.19	0.23	
			U	D	4.38				0.19	0.83	
			U	B	5.92				0.08	0.47	
			A	B	3.96				1.63	6.45	
			U	D	12.71				0.19	2.41	
			A	B	5.12				1.63	8.35	
			A	B	2.27				1.63	3.70	
			U	B	1.34				0.08	0.11	
			A	B	2.2				1.63	3.59	
			U	D	2.38				0.19	0.45	
			0.7	D	1.98				0.49	0.97	
			0.7	C	1.19				0.49	0.58	
			U	C	3.1				0.12	0.37	
			U	C	1.61				0.12	0.19	0.47
C22	22.7		A	C	1.66				2.42	4.02	
			1	C	1.13				0.43	0.49	
	23.2		1	D	4.19				0.43	1.80	
			1	D	5.28				0.43	2.27	
			1	D	5.34				0.43	2.30	
			U	D	4.8				0.19	0.91	
			U	D	0.43				0.19	0.08	
			U	C	0.37				0.12	0.04	0.51
C23	18.88		U	D	9.37				0.19	1.78	
			U	C	2.01				0.12	0.24	

WEST POINT WATER QUALITY DATA

ST POINT CREEK WATERSHED

EXISTING LAND USE

SUBAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
	18.6		U	D	1.37				0.19	0.26	
			A	C	0.9				2.42	2.18	
			A	D	1.37				3.71	5.08	
			A	C	0.69				2.42	1.67	
			A	C	1.6				2.42	3.87	
			A	D	1.29				3.71	4.79	1.07
C24	22.86		U	D	4.48				0.19	0.85	
			0.7	D	0.55				0.49	0.27	
	22.22		0.7	C	0.93				0.49	0.46	
			U	D	0.58				0.19	0.11	
			U	D	0.93				0.19	0.18	
			0.5	D	1.35				0.54	0.73	
			U	D	4.86				0.19	0.92	
			A	D	0.76				3.71	2.82	
			A	C	0.3				2.42	0.73	
			U	C	0.54				0.12	0.06	
			A	C	0.32				2.42	0.77	
			A	D	0.42				3.71	1.56	
			0.7	D	0.63				0.49	0.31	
			0.5	C	0.78				0.54	0.42	
			0.7	C	4.79				0.49	2.35	0.56
C25	19.93		U	D	5.78				0.19	1.10	
			U	C	1.35				0.12	0.16	
	19.85		A	D	0.63				3.71	2.34	
			A	C	1.12				2.42	2.71	
			A	D	0.59				3.71	2.19	
			A	C	0.69				2.42	1.67	
			A	A	0.63				0.83	0.52	
			A	C	0.13				2.42	0.31	
			U	C	1.72				0.12	0.21	
			A	C	4.33				2.42	10.48	
			A	D	1.07				3.71	3.97	
			0.5	C	0.96				0.54	0.52	
			A	C	0.85				2.42	2.06	1.42
C26	43.23		U	C	2.75				0.12	0.33	

WEST POINT WATER QUALITY DATA

:T POINT CREEK WATERSHED

EXISTING LAND USE

AREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
=======	=========	=========	=========	=========	=========	=========	=========	=========	=========	=========	
			U	D	10.41				0.19	1.98	
	45.19		A	D	3.52				3.71	13.06	
			A	B	0.49				1.63	0.80	
			A	D	1.46				3.71	5.42	
			U	D	0.75				0.19	0.14	
			0.7	D	2.19				0.49	1.07	
			U	D	5.73				0.19	1.09	
			0.5	D	3.52				0.54	1.90	
			0.5	B	2.19				0.54	1.18	
			0.5	C	1.01				0.54	0.55	
			0.7	C	1.21				0.49	0.59	
			0.7	B	1.35				0.49	0.66	
			0.7	C	4.78				0.49	2.34	
			INST	D	1.26				1.38	1.74	
			INST	B	2.57				1.38	3.55	0.81
											=========
											0.74
:GNOLIA TRIB TO MATTAPONI											
C27	37.92		A	D	1.12				3.71	4.16	
			A	C	1.3				2.42	3.15	
	34.04		A	D	1.11				3.71	4.12	
			A	C	0.88				2.42	2.13	
			0.5	C	1.92				0.54	1.04	
			0.5	D	4.21				0.54	2.27	
			0.5	C	1.46				0.54	0.79	
			0.7	C	0.95				0.49	0.47	
			0.7	D	1.4				0.49	0.69	
			0.7	C	0.35				0.49	0.17	
			A	D	0.66				3.71	2.45	
			A	B	1.11				1.63	1.81	
			A	C	0.38				2.42	0.92	
			U	C	2.07				0.12	0.25	
			U	B	2.51				0.08	0.20	
			U	C	2.98				0.12	0.36	
			U	D	1.38				0.19	0.26	
			INST	D	2.3				1.38	3.17	
			INST	C	5.95				1.38	8.21	1.08

WEST POINT WATER QUALITY DATA

T POINT CREEK WATERSHED

EXISTING LAND USE

AREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
C28	47.38		U	C	2.97				0.12	0.36	
			0.5	C	3.84				0.54	2.07	
	46.91		0.5	B	1.57				0.54	0.85	
			0.5	D	2.11				0.54	1.14	
			U	C	0.5				0.12	0.06	
			A	C	1.37				2.42	3.32	
			1	C	0.76				0.43	0.33	
			1	C	0.39				0.43	0.17	
			1	B	3.01				0.43	1.29	
			A	B	3.86				1.63	6.29	
			A	C	1.89				2.42	4.57	
			A	B	1.13				1.63	1.84	
			A	D	3.64				3.71	13.50	
			A	B	2.32				1.63	3.78	
			1	D	0.8				0.43	0.34	
			U	B	5.14				0.08	0.41	
			U	D	3.77				0.19	0.72	
			0.7	C	4.94				0.49	2.42	
			A	D	1.37				3.71	5.08	
			A	B	1.53				1.63	2.49	1.09
C285	35.23		A	C	0.69				2.42	1.67	
			0.6	B	0.5				0.52	0.26	
	29.6		A	B	3.33				1.63	5.43	
			A	C	1.51				2.42	3.65	
			F	C	0.89				0.12	0.11	
			F	B	0.63				0.08	0.05	
			1.5	B	0.86				0.38	0.33	
			1.5	C	0.56				0.38	0.21	
		(4)	U	C	0				0.12	0.00	
			U	B	7.28				0.08	0.58	
			1	B	2.35				0.43	1.01	
			1	D	1.01				0.43	0.43	
			1	B	2.36				0.43	1.01	
			A	B	3.54				1.63	5.77	
			A	B	1.41				1.63	2.30	
			1	B	0.69				0.43	0.30	
			A	D	0.72				3.71	2.67	

WEST POINT WATER QUALITY DATA

ST POINT CREEK WATERSHED

EXISTING LAND USE

IAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
=======	=========	=========	=========	=========	=========	=========	=========	=========	=========	=========	
			A	B	1.27				1.63	2.07	0.94
											=========
											1.04
RTH CHELSEA TRIB TO MATTAPONI											
C29	24.71		A	C	2.71				2.42	6.56	
			U	B	1.54				0.08	0.12	
	23.29		U	C	9.46				0.12	1.14	
			U	D	8.04				0.19	1.53	
			1	C	1.54				0.43	0.66	0.43
C30	30.26		A	C	2.05				2.42	4.96	
			1	C	0.87				0.43	0.37	
	27.99		1	B	5.31				0.43	2.28	
			1	C	5.68				0.43	2.44	
			1	B	9.26				0.43	3.98	
			1	C	1.93				0.43	0.83	
			1	B	2.89				0.43	1.24	0.58
C31	19.58		U	B	1.8				0.08	0.14	
			U	D	7.15				0.19	1.36	
	19.56		U	C	8.35				0.12	1.00	
			U	B	1.31				0.08	0.10	
			U	B	0.95				0.08	0.08	0.14
C32	40.03		1.2	B	1.07				0.43	0.46	
			U	B	2.01				0.08	0.16	
	20.99		A	B	1.25				1.63	2.04	
			A	C	3.95				2.42	9.56	
			1	C	1.14				0.43	0.49	
			U	C	1.1				0.12	0.13	
		(13.67)	U	D	1.02				0.19	0.19	
		(11.67)	U	C	6.47				0.12	0.78	
			U	B	2.98				0.08	0.24	0.67
C33	32.31		U	B	15.45				0.08	1.24	
			U	D	9.96				0.19	1.89	

WEST POINT WATER QUALITY DATA

:T POINT CREEK WATERSHED

EXISTING LAND USE

AREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
			U	A	7.27				0.04	0.29	0.10
C34	277.41	(26)	U	A	15.36				0.04	0.61	
		(37.44)	U	B	6.23				0.08	0.50	
	50.27	(64.49)	U	C	8.06				0.12	0.97	
		(124.01)	U	D	20.62				0.19	3.92	0.15
											=========
											0.30

:MPSON TRIB TO MATTAPONI

AREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
C35	7.56		F	D	0.93				0.19	0.18	
			A	D	2.06				3.71	7.64	
	7.19		A	C	0.72				2.42	1.74	
			A	C	0.46				2.42	1.11	
			A	C	0.06				2.42	0.15	
			A	C	0.87				2.42	2.11	
			0.5	C	0.37				0.54	0.20	
			A	C	0.18				2.42	0.44	
			F	D	0.15				0.19	0.03	
			F	C	0.36				0.12	0.04	
			F	D	0.22				0.19	0.04	
			A	D	0.81				3.71	3.01	2.32
C36	17.15		0.7	C	1.35				0.49	0.66	
			1.4	C	0.71				0.43	0.31	
	15.56		A	C	0.71				2.42	1.72	
			1.4	D	1.75				0.43	0.75	
			A	D	0.89				3.71	3.30	
		(2.37)	U	D	1.48				0.19	0.28	
			A	C	1.02				2.42	2.47	
		(1.77)	U	C	1.3				0.12	0.16	
			A	C	0.72				2.42	1.74	
			A	D	5.63				3.71	20.89	2.07
C37	12.21		INST	B	0.39				1.38	0.54	
			INST	D	0.79				1.38	1.09	
	8.95		INST	B	0.9				1.38	1.24	
			0.9	B	0.89				0.45	0.40	

WEST POINT WATER QUALITY DATA

ST POINT CREEK WATERSHED

EXISTING LAND USE

3AREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
			A	B	1.57				1.63	2.56	
			U	B	0.71				0.08	0.06	
			A	C	0.22				2.42	0.53	
			U	C	2.23				0.12	0.27	
		(2.92)	U	D	0				0.19	0.00	
			0.7	C	0.33				0.49	0.16	
			U	C	0.92				0.12	0.11	0.78
C38	17.61		U	C	1.08				0.12	0.13	
			U	B	2.22				0.08	0.18	
	10.17	(14.47)	U	D	6.87				0.19	1.31	0.16
C39	28.54		INST	C	1.35				1.38	1.86	
			INST	D	5.52				1.38	7.62	
			INST	B	16.26				1.38	22.44	
			0.9	C	1.17				0.45	0.53	
			INST	D	1.1				1.38	1.52	
			INST	C	1.64				1.38	2.26	1.34
C40	24.33		0.9	C	15.64				0.45	7.04	
			A	D	1.81				3.71	6.72	
			0.9	B	3.82				0.45	1.72	
			U	B	3.27				0.08	0.26	0.64
											=========
											1.17
Y1	11.88		0.25	B	3.59				0.75	2.69	
			0.25	D	8.19				0.75	6.14	0.75
M1	72.77		LC	B	6.69				1.59	10.64	
			0.25	B	33.12				0.75	24.84	
	72.43		US	D							
			LI	D	3.26				1.48	4.82	
			US	D							
			0.25	D	1.48				0.75	1.11	

WEST POINT WATER QUALITY DATA

ST POINT CREEK WATERSHED — EXISTING LAND USE

AREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
			US	D							0.93
M2	26.54		US	D							
			LI	D	5.68				1.48	8.41	
	17.67		LI	C	2.89				1.48	4.28	
			US	C							
			US	D							1.48
M3	403.99		0.5	C	0.88				0.54	0.48	
			US	C							
	400.52		A	D	7				3.71	25.97	
			A	C	4.21				2.42	10.19	
			A	D	5.38				3.71	19.96	
			1.1	D	11				0.43	0.47	
			A	D	5.8				3.71	21.52	
			US	D							3.22
M4	194.26		A	C	8.48				2.42	20.52	
			A	B	1.87				1.63	3.05	
	194.26		0.9	B	0.98				0.45	0.44	
			F	C	0.61				0.12	0.07	
			US	D							
			A	D	1.99				3.71	7.38	
			0.5	D	2.35				0.54	1.27	
			A	D	1.8				3.71	6.68	
			A	B	0.61				1.63	0.99	
			F	C	0.69				0.12	0.08	
			0.8	C	0.72				0.47	0.34	
			US	C							
			US	B							
			US	D							
			0.7	C	1.5				0.49	0.74	
			A	C	3.33				2.42	8.06	
			A	B	2.95				1.63	4.81	
			A	D	3.75				3.71	13.91	

WEST POINT WATER QUALITY DATA

IT POINT CREEK WATERSHED

EXISTING LAND USE

AREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
			1.5	D	2.45				0.38	0.93	
			US	B							
			LC	B	3.98				1.59	6.33	
			LC	D	1.33				1.59	2.11	
			1	B	1.3				0.43	0.56	
			1	D	4.69				0.43	2.02	
			A	B	6.88				1.63	11.21	
			A	C	2.58				2.42	6.24	
			US	D							1.78
M5	81.84		1	C	1.07				0.43	0.46	
			1.5	C	4.01				0.38	1.52	
	92.43		F	C	0.44				0.12	0.05	
			F	B	0.32				0.08	0.03	
			1.5	B	1.77				0.38	0.67	
			1.5	C	4.23				0.38	1.61	
			1	B	15.21				0.43	6.54	
			1	C	5.57				0.43	2.40	
			US	C							
			US	D							
			1	D	4.51				0.43	1.94	
			0.3	D	0.37				0.64	0.24	
			US	D							
			0.9	D	0.98				0.45	0.44	
			US	D							0.41
P1	128.02		0.25	D	7.25				0.75	5.44	
			0.25	B	6.31				0.75	4.73	
	104.81		0.25	B	13.91				0.75	10.43	
			LC	B	8.59				1.59	13.66	
			US	D							
			HI	D	29.73				1.9	56.49	
			HI	D	1.38				1.9	2.62	
			HI	D	0.67				1.9	1.27	
			0.3	D	0.53				0.64	0.34	
			HI	D	2.15				1.9	4.09	

WEST POINT WATER QUALITY DATA

'T POINT CREEK WATERSHED

EXISTING LAND USE

AREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
			F	D	16.05				0.19	3.05	
			US	D							
			HI	D	8.53				1.9	16.21	
			0.25	B	1.97				0.75	1.48	
			HI	B	5.64				1.9	10.72	
			0.4	B	1.14				0.6	0.68	
			HC	B	0.96				1.9	1.82	1.27
P2	168.43		HI	D	103.66				1.9	196.95	
			HC	B	5.66				1.9	10.75	
	169.97		0.3	C	13.18				0.64	8.44	
			HC	C	5.7				1.9	10.83	
			HI	C	19.36				1.9	36.78	
			0.5	C	1.02				0.54	0.55	
			F	C	6.71				0.12	0.81	
			CEM	C	3.47				1.06	3.68	
			F	C	0.62				0.12	0.07	
			0.3	C	2.84				0.64	1.82	
			F	C	1.86				0.12	0.22	
			HC	C	4.95				1.9	9.41	
			F	C	0.94				0.12	0.11	1.65
P3	107.68		HI	D	7.55				1.9	14.35	
			HI	C	6.14				1.9	11.67	
	95.61		HI	D	15.43				1.9	29.32	
			W	D							
			W	C							
			HI	C	11.49				1.9	21.83	
			0.3	C	17.64				0.64	11.29	
			US	C							
			HC	C	0.5				1.9	0.95	
			F	C	1.14				0.12	0.14	
			0.8	C	7.77				0.47	3.65	
			1	C	1.52				0.43	0.65	
			F	C	0.37				0.12	0.04	
			0.8	C	3.49				0.47	1.64	

WEST POINT WATER QUALITY DATA

:T POINT CREEK WATERSHED

EXISTING LAND USE

AREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
			W	C							
			HC	C	0.46				1.9	0.87	
			0.9	C	5.39				0.45	2.43	
			HI	C	4.85				1.9	9.21	
			F	C	1.09				0.12	0.13	
			0.4	C	1.92				0.6	1.15	
			APT	C	0.98				1.17	1.15	
			0.5	C	1.51				0.54	0.82	
			HI	C	4.98				1.9	9.46	
			0.9	C	1.02				0.45	0.46	
			US	C							
			0.4	C	0.37				0.6	0.22	1.27
P4	45.25		US	C							
			0.4	C	3.39				0.6	2.03	
	35.64		F	C	3.94				0.12	0.47	
			F	C	1.7				0.12	0.20	
			0.8	C	4.78				0.47	2.25	
			1	C	21.83				0.43	9.39	
			US	D							0.40
P5	59.73		US	D							
			US	C							
	19.53		1	C	19.53				0.43	8.40	0.43
P6	163.64		F	C	13.72				0.12	1.65	
			F	D	19.71				0.19	3.74	
	157.65		0.6	C	0.47				0.52	0.24	
			F	C	3.01				0.12	0.36	
			0.25	C	3.09				0.75	2.32	
			F	C	5.72				0.12	0.69	
			0.7	C	11.07				0.49	5.42	
			LC	C	2.59				1.59	4.12	
			LC	C	4.2				1.59	6.68	
			F	C	5.6				0.12	0.67	

WEST POINT WATER QUALITY DATA

ST POINT CREEK WATERSHED — EXISTING LANDUSE

3AREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	CN	COMP.CN		LOADING	WT.LOAD	
			F	C	7.73				0.12	0.93	
			0.9	C	76.07				0.45	34.23	
			0.9	D	5.37				0.45	2.42	
			2.8	D	1.2				0.31	0.37	
			2.8	C	1.1				0.31	0.34	0.40

WEST POINT WATER QUALITY DATA

TOWN OF WEST POINT — L&M JOB 92-093 — 10/12/93

WATER QUALITY CALCULATIONS ONLY

SUBAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	LOADING	WT.LOAD	
C1	49.68	0.078	RH	B	9.85	0.85	8.37	
			RH	C	3.97	0.85	3.37	
	37.79	(6.97)	RH	D	0	0.85	0.00	
			RH	C	3.98	0.85	3.38	
			GB	B	17.89	1.8	32.20	
			GB	C	2.1	1.8	3.78	
		(4.28)	GB	D	0	1.8	0.00	1.35
C2	42.59	0.067	RH	C	3.61	0.85	3.07	
			GB	C	2.64	1.8	4.75	
	18.17		GB	D	3.73	1.8	6.71	
			GB	D	3.35	1.8	6.03	
			GB	D	2.12	1.8	3.82	
		(11.61)	COS	D	0	0.12	0.00	
		(3.04)	COS	D	0	0.12	0.00	
		(1.98)	COS	C	0	0.12	0.00	
		(6.53)	COS	D	0	0.12	0.00	
			LI	C	2.72	1.48	4.03	1.56
C3	60.77	0.095	RH	C	26.11	0.85	22.19	
			PSP	C	2.25	1.06	2.39	
	28.36	(9.77)	COS	C	0	0.12	0.00	
		(12.45)	COS	D	0	0.12	0.00	
		(7.53)	COS	B	0	0.12	0.00	0.07
C4	47.4	0.074	PSP	C	4.09	1.06	4.34	
			PSP	C	4.59	1.06	4.87	
	36.6		SD	C	13.43	1.38	18.53	
		(3.07)	COS	D	0	0.12	0.00	
		(4.57)	COS	D	0	0.12	0.00	
		(1.29)	COS	B	0	0.12	0.00	
			IND	D	4.79	1.9	9.10	
			IND	B	9.7	1.9	18.43	1.51
C5	33.47	0.052	PSP	C	8.21	1.06	8.70	
			RM	C	6.56	0.64	4.20	
	22.66	(4.7)	COS	D	0	0.12	0.00	

WEST POINT WATER QUALITY DATA

TOWN OF WEST POINT　　L&M JOB 92-093　　10/12/93

WATER QUALITY CALCULATIONS ONLY

SUBAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	LOADING	WT.LOAD	
		(3.87)	COS	B	0	0.12	0.00	
			RL	C	1.44	0.49	0.71	
			RL	B	2.02	0.49	0.99	
			RL	D	2.2	0.49	1.08	
			RL	D	2.23	0.49	1.09	0.74
C6	53.07	0.083	RM	C	23.75	0.64	15.20	
			RM	D	4.07	0.64	2.60	
	42.27		RM	B	1.09	0.64	0.70	
			RM	B	2.39	0.64	1.53	
			RM	D	0.74	0.64	0.47	
		(2.24)	COS	B	0	0.12	0.00	
		(1.8)	COS	B	0	0.12	0.00	
		(2.1)	COS	D	0	0.12	0.00	
			RL	B	0.56	0.49	0.27	
			RL	D	0.26	0.49	0.13	
			RL	B	1.82	0.49	0.89	
			RL	C	3.91	0.49	1.92	
			RL	B	2.89	0.49	1.42	
			RL	D	0.79	0.49	0.39	0.60
C7	54.06	0.084	SD	C	1.69	1.38	2.33	
			RM	C	28.95	0.64	18.53	
	53.71		RM	D	4.17	0.64	2.67	
			RM	B	18.9	0.64	12.10	0.66
C8	83.6	0.131	IND	C	4.8	1.9	9.12	
			IND	D	1.53	1.9	2.91	
	80.64		RH	C	3.15	0.85	2.68	
			RH	D	1.79	0.85	1.52	
			SD	C	10.9	1.38	15.04	
			SD	D	10.25	1.38	14.15	
			SD	C	16.5	1.38	22.77	
			SD	D	3.85	1.38	5.31	
			SD	B	2.75	1.38	3.80	
			RM	B	11.05	0.64	7.07	
			RM	C	5.68	0.64	3.64	

WEST POINT WATER QUALITY DATA

TOWN OF WEST POINT — L&M JOB 92-093 — 10/12/93

WATER QUALITY CALCULATIONS ONLY

SUBAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	LOADING	WT.LOAD	
			RM	D	7.24	0.64	4.63	
			RM	D	1.15	0.64	0.74	1.16
C9	38.51	0.060	SD	C	8.06	1.38	11.12	
			SD	D	8.84	1.38	12.20	
	35.93		RM	D	14.32	0.64	9.16	
			RM	C	0.59	0.64	0.38	
			RM	B	2.77	0.64	1.77	
			RM	C	1.35	0.64	0.86	0.99
C10	64.26	0.100	SD	C	13.85	1.38	19.11	
			SD	D	3.16	1.38	4.36	
	62.99		RM	D	11.11	0.64	7.11	
			RM	B	0.79	0.64	0.51	
			RM	C	5.55	0.64	3.55	
			RM	A	1.94	0.64	1.24	
			RM	C	3.99	0.64	2.55	
			RL	A	3.31	0.49	1.62	
			RL	C	9.19	0.49	4.50	
			RL	B	10.1	0.49	4.95	0.79
C11	107.58	0.168	SD	C	4.28	1.38	5.91	
			SD	D	12.95	1.38	17.87	
	106.93		RM	C	27.72	0.64	17.74	
			RM	D	24.75	0.64	15.84	
			RM	C	0.44	0.64	0.28	
			RM	A	3.88	0.64	2.48	
			RL	C	14.08	0.49	6.90	
			RL	D	9.07	0.49	4.44	
			RL	C	4.74	0.49	2.32	
			RL	A	5.02	0.49	2.46	0.71
C12	60.48	0.095	RL	C	2.98	0.49	1.46	
			RL	C	4.1	0.49	2.01	
	63.8		RL	B	15.95	0.49	7.82	
			RL	B	1.24	0.49	0.61	
			RL	D	28.47	0.49	13.95	

WEST POINT WATER QUALITY DATA

TOWN OF WEST POINT — L & M JOB 92-093 — 10/12/93

WATER QUALITY CALCULATIONS ONLY

SUBAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	LOADING	WT.LOAD	
			RL	C	7.09	0.49	3.47	
			RL	B	3.97	0.49	1.95	0.49
C13	39.85	0.062	RM	B	12.45	0.64	7.97	
			RM	D	7.2	0.64	4.61	
	40.21		RM	C	0.93	0.64	0.60	
			RL	C	0.47	0.49	0.23	
			RL	D	4.11	0.49	2.01	
			RL	B	15.05	0.49	7.37	0.57
C14	28.77	0.045	RM	B	3.46	0.64	2.21	
			RM	D	6.85	0.64	4.38	
	28.37		RM	B	8.66	0.64	5.54	
			RL	D	1.76	0.49	0.86	
			RL	B	5.63	0.49	2.76	
			RL	C	1.51	0.49	0.74	
			RL	C	0.5	0.49	0.25	0.59
C15	42.16	0.066	RL	B	6.59	0.49	3.23	
			RL	D	7.04	0.49	3.45	
	42.3		RL	C	27.01	0.49	13.23	
			RL	B	1.66	0.49	0.81	0.49
C16	32.22	0.050	RL	C	4.33	0.49	2.12	
			RL	D	11.32	0.49	5.55	
	32.32		RL	C	6.3	0.49	3.09	
			RL	B	5.22	0.49	2.56	
			RL	C	3.4	0.49	1.67	
			RL	B	1.75	0.49	0.86	0.49
C17	13.56	0.021	RL	C	0.19	0.49	0.09	
			RL	B	1.53	0.49	0.75	
	13.15		RL	D	3.64	0.49	1.78	
			RL	B	7.58	0.49	3.71	
			RL	D	0.21	0.49	0.10	0.49
C18	21.59	(1.73)	RL	D	1.42	0.49	0.70	

WEST POINT WATER QUALITY DATA

TOWN OF WEST POINT — L & M JOB 92-093 — 10/12/93

WATER QUALITY CALCULATIONS ONLY

SUBAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	LOADING	WT.LOAD	
		(10.36)	RL	B	9.96	0.49	4.88	
	19.92		RL	C	7.29	0.49	3.57	
		(.22)	RL	D	0	0.49	0.00	
		(.4)	RL	D	0	0.49	0.00	
			RL	C	1.25	0.49	0.61	0.49
C19	26.96	0.042	RL	C	2.42	0.49	1.19	
			RL	D	0.52	0.49	0.25	
	25.94		RL	D	2.85	0.49	1.40	
			RL	D	7.94	0.49	3.89	
			RL	C	9.98	0.49	4.89	
			RL	B	2.23	0.49	1.09	0.49
C20	20.25	0.032	IND	D	3.42	1.9	6.50	
		(16.83)	COS	D	12.2	0.12	1.46	
	16.32		COS	C	0.7	0.12	0.08	0.49
C21	68.64	(1.69)	COS	D	0	0.12	0.00	
			COS	C	5.29	0.12	0.63	
	63.73	(1.51)	COS	D	0	0.12	0.00	
			IND	B	0.61	1.9	1.16	
			IND	D	13.1	1.9	24.89	
			IND	C	4.01	1.9	7.62	
			IND	B	11.91	1.9	22.63	
			IND	C	9.2	1.9	17.48	
			IND	B	1.53	1.9	2.91	
			RL	B	2.1	0.49	1.03	
			RL	D	7.79	0.49	3.82	
			RL	C	1.38	0.49	0.68	
			RL	C	2.77	0.49	1.36	
			RL	B	4.04	0.49	1.98	1.35
C22	22.7	0.035	RL	C	2.01	0.49	0.98	
			RL	D	5.63	0.49	2.76	
	22.85		RL	C	11.49	0.49	5.63	
			PSP	C	0.91	1.06	0.96	
			PSP	D	1.72	1.06	1.82	

WEST POINT WATER QUALITY DATA

TOWN OF WEST POINT — L&M JOB 92-093 — 10/12/93

WATER QUALITY CALCULATIONS ONLY

SUBAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	LOADING	WT.LOAD	
			PSP	C	1.09	1.06	1.16	0.53
C23	18.88	0.030	IND	D	1.42	1.9	2.70	
			IND	C	2.82	1.9	5.36	
	18.72		IND	D	11.83	1.9	22.48	
			IND	C	2.65	1.9	5.04	1.90
C24	22.86	0.036	IND	D	1.59	1.9	3.02	
			RL	D	12.07	0.49	5.91	
	22.74		RL	C	1.72	0.49	0.84	
			RL	C	1.14	0.49	0.56	
			RL	C	6.22	0.49	3.05	0.59
C25	19.93	0.031	IND	D	2.17	1.9	4.12	
			IND	C	2.57	1.9	4.88	
	17.63		IND	D	1.43	1.9	2.72	
			RL	D	4.28	0.49	2.10	
			RL	C	7.18	0.49	3.52	0.98
C26	43.23	0.068	IND	B	0.25	1.9	0.48	
			IND	D	9.71	1.9	18.45	
	42.56		IND	C	2.84	1.9	5.40	
			RL	D	19.16	0.49	9.39	
			RL	B	6.19	0.49	3.03	
			RL	C	2.63	0.49	1.29	
			PSP	C	0.94	1.06	1.00	
			PSP	B	0.84	1.06	0.89	0.94
					996.61			0.84

MAGNOLIA TRIB. TO MATTAPONI

SUBAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	LOADING	WT.LOAD
C27	37.92	0.059	PSP	C	9.1	1.06	9.65
			PSP	D	5.49	1.06	5.82
	36.97		PSP	C	3.21	1.06	3.40
			PSP	D	0.8	1.06	0.85
			RL	D	1.25	0.49	0.61

WEST POINT WATER QUALITY DATA

TOWN OF WEST POINT — L&M JOB 92-093 — 10/12/93

WATER QUALITY CALCULATIONS ONLY

SUBAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	LOADING	WT.LOAD	
			RL	C	4.33	0.49	2.12	
			RL	D	5.44	0.49	2.67	
			RL	C	3.19	0.49	1.56	
			RL	B	4.16	0.49	2.04	0.73
C28	47.38	0.074	RL	C	3.32	0.49	1.63	
			RL	B	6.88	0.49	3.37	
	46.08		RL	D	0.38	0.49	0.19	
			RL	D	8.39	0.49	4.11	
			RL	B	9.52	0.49	4.66	
			RL	D	0.72	0.49	0.35	
			RL	C	5.32	0.49	2.61	
			RL	B	2.63	0.49	1.29	
			RL	C	8.92	0.49	4.37	0.49
C285	35.23	0.055	RL	B	19.51	0.49	9.56	
			RL	C	0.91	0.49	0.45	
	30.53		RL	D	2.91	0.49	1.43	
			RL	B	5.71	0.49	2.80	
			RL	C	1.49	0.49	0.73	
		(3.96)	COS	C	0	0.12	0.00	0.49
								=========
					113.58			0.58

NORTH CHELSEA TRIB. TO MATTAPONI

SUBAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	LOADING	WT.LOAD	
C29	24.71	0.039	RL	D	8.22	0.49	4.03	
			RL	C	14.73	0.49	7.22	
	24.62		RL	B	1.67	0.49	0.82	0.49
C30	30.26	0.047	RL	C	9.6	0.49	4.70	
			RL	B	5.41	0.49	2.65	
	30.11		RL	B	9.54	0.49	4.67	
			RL	C	2.83	0.49	1.39	
			RL	B	2.73	0.49	1.34	0.49

WEST POINT WATER QUALITY DATA

TOWN OF WEST POINT — L&M JOB 92-093 — 10/12/93

WATER QUALITY CALCULATIONS ONLY

SUBAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	LOADING	WT.LOAD	
C31	19.58	0.031	RL	B	1.95	0.49	0.96	
			RL	D	6.72	0.49	3.29	
			RL	C	8.27	0.49	4.05	
			RL	B	0.85	0.49	0.42	
			RL	B	1.29	0.49	0.63	0.49
C32	40.03	0.063	RL	B	3.13	0.49	1.53	
			RL	D	10.77	0.49	5.28	
	22.11		RL	B	4.03	0.49	1.97	
			RL	C	2.49	0.49	1.22	
			RL	D	1.69	0.49	0.83	
		(12.65)	COS	D	0	0.12	0.00	
		(5.2)	COS	C	0	0.12	0.00	0.49
C33	32.31	0.050	RL	B	15.56	0.49	7.62	
			RL	D	13.93	0.49	6.83	
		(1.94)	COS	D	0	0.12	0.00	
		(1.24)	COS	C	0	0.12	0.00	0.49
C34	277.41	0.433	RL	A	15.36	0.49	7.53	
		40.69	RL	B	6.23	0.49	3.05	
	50.27	69.22	RL	C	8.06	0.49	3.95	
		122.08	RL	D	20.62	0.49	10.10	0.49
					175.68			0.49
THOMPSON TRIB. TO MATTAPONI								
C35	7.56	0.012	RL	C	0.08	0.49	0.04	
			RL	C	1.09	0.49	0.53	
	7.45		RL	C	1.96	0.49	0.96	
			RL	D	0.94	0.49	0.46	
			RL	D	3.38	0.49	1.66	0.49
C36	17.15	0.027	RL	C	2.79	0.49	1.37	
			RL	D	1.61	0.49	0.79	
	15.89		RL	C	3.1	0.49	1.52	
			RL	D	8.39	0.49	4.11	

WEST POINT WATER QUALITY DATA

TOWN OF WEST POINT — L&M JOB 92-093 — 10/12/93

WATER QUALITY CALCULATIONS ONLY

SUBAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	LOADING	WT.LOAD	
		(.47)	COS	C	0	0.12	0.00	
		(.89)	COS	D	0	0.12	0.00	0.49
C37	12.21	0.019	RL	B	4.1	0.49	2.01	
			RL	C	2.23	0.49	1.09	
	9.61		RL	D	1.5	0.49	0.74	
			RL	B	0.38	0.49	0.19	
			RL	C	1.4	0.49	0.69	
		(2.23)	COS	D	0	0.12	0.00	0.49
C38	17.61	0.028	RL	C	1.09	0.49	0.53	
			RL	B	2.33	0.49	1.14	
	10.12		RL	D	4.45	0.49	2.18	
			RL	D	2.25	0.49	1.10	
		(7.6)	COS	D	0	0.12	0.00	0.49
C39	28.54	0.045	PSP	D	0.64	1.06	0.68	
			PSP	B	0.74	1.06	0.78	
	27.61		PSP	D	7.33	1.06	7.77	
			PSP	B	3.16	1.06	3.35	
			RL	B	12.65	0.49	6.20	
			RL	C	2.84	0.49	1.39	
			RL	D	0.25	0.49	0.12	0.74
C40	24.33	0.038	RL	B	1.82	0.49	0.89	
			RL	C	9.34	0.49	4.58	
	24.54		RL	C	5.05	0.49	2.47	
			RL	B	8.33	0.49	4.08	0.49
					95.22			0.56
Y1	11.88		RH	B	3.51	0.85	2.98	
	11.63		RH	D	8.12	0.85	6.90	0.85
M1	72.77		RH	B	15.72	0.85	13.36	
			RH	D		0.85	0.00	

WEST POINT WATER QUALITY DATA

TOWN OF WEST POINT — L&M JOB 92-093 — 10/12/93

WATER QUALITY CALCULATIONS ONLY

SUBAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	LOADING	WT.LOAD	
	44.53		GB	B	5.84	1.8	10.51	
			RH	B	18.21	0.85	15.48	
			RH	D	4.76	0.85	4.05	0.97
M2	26.54		COS	D		0.12	0.00	
			LI	C	2.89	1.48	4.28	
	16.37		LI	D	6	1.48	8.88	
			PSP	D	2.4	1.06	2.54	
			GB	D	3.43	1.8	6.17	
			GB	D	1.65	1.8	2.97	1.52
M3	403.99		IND	D	17.32	1.9	32.91	
			IND	C	4.21	1.9	8.00	
	27.88		RL	C	5.21	0.49	2.55	
			RL	C	1.14	0.49	0.56	
			COS	D		0.12	0.00	1.59
M4	194.26		RL	C	2.58	0.49	1.26	
			RL	B	17.42	0.49	8.54	
	48.02		RL	D	10.84	0.49	5.31	
			RL	C	12.6	0.49	6.17	
			RL	B	4.58	0.49	2.24	
			COS	D		0.12	0.00	0.49
M5	81.84		COS	D		0.12	0.00	
			COS	C		0.12	0.00	
	37.04		RL	C	8.6	0.49	4.21	
			RL	B	18.47	0.49	9.05	
			RL	C	9.97	0.49	4.89	
			RL	D		0.49	0.00	
			COS	D		0.12	0.00	0.49

WEST POINT WATER QUALITY DATA

TOWN OF WEST POINT — L&M JOB 92-093 — 10/12/93

WATER QUALITY CALCULATIONS ONLY

SUBAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	LOADING	WT.LOAD	
P1	128.02		RH	D	15.32	0.85	13.02	
			RH	B	6.81	0.85	5.79	
	114.25		GB	B	13.36	1.8	24.05	
			RH	B	14.04	0.85	11.93	
			GB	B	6.99	1.8	12.58	
			IND	D	50.82	1.9	96.56	
			IND	B	6.91	1.9	13.13	1.55
P2	168.48		RH	C	15.91	0.85	13.52	
			GB	C	4.96	1.8	8.93	
	168.99		IND	D	100.45	1.9	190.86	
			IND	C	17.09	1.9	32.47	
			SD	C	8.46	1.38	11.67	
			PSP	C	14.31	1.06	15.17	
			PSP	C	2.31	1.06	2.45	
			GB	B	5.5	1.8	9.90	1.69
P3	107.68		IND	D	18.49	1.9	35.13	
			IND	C	17.51	1.9	33.27	
	94.68		IND	C	3.43	1.9	6.52	
			RH	C	15.06	0.85	12.80	
			SD	C	36.44	1.38	50.29	
			IND	C	3.75	1.9	7.13	1.53
P4	45.25		IND	C	0	1.9	0.00	
			RH	C	16.09	0.85	13.68	
	34.6		RL	C	18.51	0.49	9.07	
			COS	D		0.12	0.00	0.66
P5	59.73		RH	C	0	0.85	0.00	
			RL	C	21.27	0.49	10.42	
	21.27		COS	C		0.12	0.00	
			COS	D		0.12	0.00	0.49

WEST POINT WATER QUALITY DATA

TOWN OF WEST POINT — L&M JOB 92-093 — 10/12/93

WATER QUALITY CALCULATIONS ONLY

SUBAREA	AREA (acres)	AREA (sq.mi)	LAND USE	SOIL GROUP	AREA	LOADING	WT.LOAD	
P6	163.64		RL	C	94.82	0.49	46.46	
			RH	C	11.2	0.85	9.52	
	160.26		SD	C	25.16	1.38	34.72	
			LI	C	11.88	1.48	17.58	
			RH	D	4.26	0.85	3.62	
			RM	C	12.94	0.64	8.28	0.75

APPENDIX 4
COST ESTIMATING WORKSHEETS

LANGLEY & McDONALD, P.C. 8 12 1993
5544 GREENWICH ROAD
VIRGINIA BEACH, VA. 23462

PRELIMINARY COST ESTIMATING WORKSHEET

TOWN OF WEST POINT, VIRGINIA
7th & MAIN

JOB NO. 92093

UPGRADE EXISTING STM. SYSTEM TO CARRY ULTIMATE 10 YR. STM

LINE ITEM	QUANT	UN	UNIT PRICE	ESTIMATED COST	
01 15" RCP	22	LF	$16.00	$352.00	
02 18" RCP	33	LF	$18.00	$594.00	
03 27" RCP	277	LF	$29.00	$8,033.00	
04 30" RCP	339	LF	$36.00	$12,204.00	
05 14x23 ELL. CONC	300	LF	$27.00	$8,100.00	TWIN PIPE 150'
06 CATCH BASIN REMOVAL	3	EA	$400.00	$1,200.00	
07 PIPE REMOVAL	821	LF	$4.50	$3,694.50	
08 CATCH BASIN REPLACEMENT	6	EA	$2,000.00	$12,000.00	
09 CURB & GUTTER REMOVAL	120	LF	$3.50	$420.00	
10 CURB & GUTTER REPLACEMENT	120	LF	$7.50	$900.00	
11 ASPHALT PAVEMENT REMOVAL	400	SY	$3.50	$1,400.00	
12 ASPHALT PAVEMENT REPLACEMENT	400	SY	$12.00	$4,800.00	
13 RELOCATION OF EXIST. UTILITIES	1	LS	$7,000.00	$7,000.00	
14 SELECT MATERIAL	300	CY	$8.00	$2,400.00	
15 SELECT BEDDING	30	TN	$21.00	$630.00	
16 RIP RAP	10	SY	$30.00	$300.00	
17 SIDEWALK REMOVAL	80	LF	$3.00	$240.00	
18 SIDEWALK REPLACEMENT	35	SY	$16.50	$577.50	
19 TOPSOIL & SEEDING	400	SY	$1.00	$400.00	
201 HAUL OFF UNSUITABLE MATERIAL	300	CY	$3.00	$900.00	

SUB. TOTAL		$66,145.00
MOBILIZ./BONDS/INSUR.	5%	$3,307.25
EROS. & SED. CONTROL	2%	$1,322.90
TRAFFIC CONTROL	2%	$1,322.90
PROFFESSIONAL SERVICES	15%	$9,921.75
CONTINGENCY	10%	$6,614.50
GRAND TOTAL		$88,634.30

LANGLEY & McDONALD, P.C.
5544 GREENWICH ROAD
VIRGINIA BEACH, VA. 23462

8 9 1993

PRELIMINARY COST ESTIMATING WORKSHEET

TOWN OF WEST POINT, VIRGINIA
KING WILLIAM AVE.
JOB NO. 92093

UPGRADE EXISTING STM. SYSTEM TO CARRY ULTIMATE 10 YR. STM

LINE ITEM	QUANT	UN	UNIT PRICE	ESTIMATED COST
01 12" RCP	120	LF	$15.00	$1,800.00
02 18" RCP	72	LF	$18.00	$1,296.00
03 21" RCP	343	LF	$22.00	$7,546.00
04 24" RCP	102	LF	$27.00	$2,754.00
05 30" RCP	51	LF	$36.00	$1,836.00
06 36" RCP	358	LF	$44.00	$15,752.00
07 42" RCP	331	LF	$50.00	$16,550.00
08 48" RCP	699	LF	$65.00	$45,435.00
09 54" RCP	1149	LF	$80.00	$91,920.00
10 48"x76" ELL. RCP (60")	705	LF	$135.00	$95,175.00
11 58"x91" ELL. RCP (72")	147	LF	$170.00	$24,990.00
12 CATCH BASIN REMOVAL	27	EA	$400.00	$10,800.00
13 PIPE REMOVAL	4077	LF	$4.50	$18,346.50
14 CATCH BASIN REPLACEMENT	27	EA	$2,600.00	$70,200.00
15 CURB & GUTTER REMOVAL	2500	LF	$3.50	$8,750.00
16 CURB & GUTTER REPLACEMENT	2500	LF	$7.50	$18,750.00
17 ASPHALT PAVEMENT REMOVAL	1500	SY	$3.50	$5,250.00
18 ASPHALT PAVEMENT REPLACEMENT	1500	SY	$12.00	$18,000.00
19 RELOCATION OF EXIST. UTILITIES	1	LS	$25,000.00	$25,000.00
20 SELECT MATERIAL	2300	CY	$8.00	$18,400.00
21 SELECT BEDDING	200	TN	$21.00	$4,200.00
22 RIP RAP	20	SY	$30.00	$600.00
23 WIDEN & REGRADE EXIST. DITCH	1	LS	$5,000.00	$5,000.00
24 SIDEWALK REMOVAL	2800	LF	$3.00	$8,400.00
25 SIDEWALK REPLACEMENT	1250	SY	$16.50	$20,625.00
26 TOPSOIL & SEEDING	3000	SY	$1.00	$3,000.00
27 HAUL OFF UNSUITABLE MATERIAL	2500	CY	$3.00	$7,500.00

SUB. TOTAL		$547,875.50
MOBILIZ./BONDS/INSUR.	5%	$27,393.78
EROS. & SED. CONTROL	2%	$10,957.51
TRAFFIC CONTROL	2%	$10,957.51
PROFFESSIONAL SERVICES	15%	$82,181.33
CONTINGENCY	10%	$54,787.55
GRAND TOTAL		$734,153.17

LANGLEY & McDONALD, P.C. 10 12 1993
544 GREENWICH ROAD
VIRGINIA BEACH, VA. 23462

PRELIMINARY COST ESTIMATING WORKSHEET

TOWN OF WEST POINT, VIRGINIA
KIRBY ST. & 16TH ST.

JOB NO. 92093

LINE	ITEM	QUANT	UN	UNIT PRICE	ESTIMATED COST
1	18" RCP	54	LF	$18.00	$972.00
2	24" RCP	12	LF	$29.00	$348.00
3	ES-1 24"	1	EA	$575.00	$575.00
4	PIPE REMOVAL	66	LF	$4.50	$297.00
5	CATCH BASIN REMOVAL	2	EA	$400.00	$800.00
6	CATCH BASIN REPLACEMENT	2	EA	$1,500.00	$3,000.00
7	CURB & GUTTER REMOVAL	8	LF	$3.50	$28.00
8	CURB & GUTTER REPLACEMENT	8	LF	$7.50	$60.00
9	ASPHALT PAVEMENT REMOVAL	25	SY	$3.50	$87.50
10	ASPHALT PAVEMENT REPLACEMENT	25	SY	$12.00	$300.00
11	RELOCATION OF EXIST. UTILITIES	1	LS	$1,000.00	$1,000.00
12	SELECT MATERIAL	20	CY	$8.00	$160.00
13	RIP RAP	6	SY	$30.00	$180.00
14	TOPSOIL & SEEDING	100	SY	$1.00	$100.00
15	HAUL OFF UNSUITABLE MATERIAL	20	CY	$3.00	$60.00

SUB. TOTAL		$7,967.50
MOBILIZ./BONDS/INSUR.	5%	$398.38
EROS. & SED. CONTROL	2%	$159.35
TRAFFIC CONTROL	2%	$159.35
PROFFESSIONAL SERVICES	15%	$1,195.13
CONTINGENCY	10%	$796.75
GRAND TOTAL		$10,676.45

LANGLANGLEY & McDONALD, P.C. 8 16 1993
55445544 GREENWICH ROAD
VIRGVIRGINIA BEACH, VA. 23462

PRELPRELIMINARY COST ESTIMATING WORKSHEET

TOWNTOWN OF WEST POINT, VIRGINIA
PROPPROPOSED ULTIMATE SYSTEM AT OLD OUTFALL NO. 1208

JOB JOB NO. 92093

LINELINE ITEM		QUANT	UN	UNIT PRICE	ESTIMATED COST
1	1 12" RCP	250	LF	$15.00	$3,750.00
2	2 15" RCP	440	LF	$16.50	$7,260.00
3	3 24" RCP	252	LF	$25.00	$6,300.00
4	4 30" RCP	210	LF	$36.00	$7,560.00
5	5 33" RCP	400	LF	$40.00	$16,000.00
6	6 36" RCP	40	LF	$45.00	$1,800.00
7	7 54" RCP	470	LF	$80.00	$37,600.00
8	8 60" RCP	484	LF	$100.00	$48,400.00
9	9 GRADE PROPOSED DITCH	540	LF	$20.00	$10,800.00
10	10 PROP EW w/WING WALLS	1	EA	$3,000.00	$3,000.00
11	11 PROP. D.I.	15	EA	$1,800.00	$27,000.00
12	12 PROP JB-1	3	EA	$3,000.00	$9,000.00
13	13 PIPE REMOVAL	680	LF	$4.50	$3,060.00
14	14 CATCH BASIN REMOVAL	6	EA	$400.00	$2,400.00
15	15 CURB & GUTTER REMOVAL	204	LF	$3.50	$714.00
16	16 CURB & GUTTER REPLACEMENT	204	LF	$7.50	$1,530.00
17	17 ASPHALT PAVEMENT REMOVAL	240	SY	$3.50	$840.00
18	18 ASPHALT PAVEMENT REPLACEMENT	240	SY	$12.00	$2,880.00
19	19 RELOCATION OF EXIST. UTILITIES	1	LS	$20,000.00	$20,000.00
20	20 SELECT MATERIAL	150	CY	$8.00	$1,200.00
21	21 RIP RAP	15	SY	$30.00	$450.00
22	22 TOPSOIL & SEEDING	2000	SY	$1.00	$2,000.00
23	23 HAUL OFF UNSUITABLE MATERIAL	150	CY	$3.00	$450.00
24	24 REPLACE 4"x4' CONC. WALK	711	SY	$16.00	$11,376.00

SUB. TOTAL		$225,370.00
MOBILIZ./BONDS/INSUR.	5%	$11,268.50
EROS. & SED. CONTROL	2%	$4,507.40
TRAFFIC CONTROL	2%	$4,507.40
PROFFESSIONAL SERVICES	15%	$33,805.50
CONTINGENCY	10%	$22,537.00
GRAND TOTAL		$301,995.80

LANGLEY & McDONALD, P.C. 8 12 1993
5544 GREENWICH ROAD
VIRGINIA BEACH, VA. 23462

PRELIMINARY COST ESTIMATING WORKSHEET

TOWN OF WEST POINT, VIRGINIA
THOMPSON AVE. & SCHOOL SITE

JOB NO. 92093

SHIFT DRAINAGE DIVIDES REMOVE 6.32 AC. FROM WESTWOOD DRAINAGE AREAS

LINE ITEM	QUANT	UN	UNIT PRICE	ESTIMATED COST
1 18" RCP	262	LF	$18.00	$4,716.00
2 27" RCP	450	LF	$29.00	$13,050.00
3 30" RCP	350	LF	$36.00	$12,600.00
4 ES-1 30"	1	EA	$575.00	$575.00
5 ES-1 18"	1	EA	$310.00	$310.00
6 PIPE REMOVAL	44	LF	$4.50	$198.00
7 CATCH BASIN REMOVAL	1	EA	$400.00	$400.00
8 CATCH BASIN REPLACEMENT	5	EA	$1,800.00	$9,000.00
9 STORM MANHOLE	1	EA	$1,200.00	$1,200.00
10 CURB & GUTTER REMOVAL	148	LF	$3.50	$518.00
11 CURB & GUTTER REPLACEMENT	148	LF	$7.50	$1,110.00
12 ASPHALT PAVEMENT REMOVAL	60	SY	$3.50	$210.00
13 ASPHALT PAVEMENT REPLACEMENT	60	SY	$12.00	$720.00
14 RELOCATION OF EXIST. UTILITIES	1	LS	$5,000.00	$5,000.00
15 SELECT MATERIAL	150	CY	$8.00	$1,200.00
16 RIP RAP	10	SY	$30.00	$300.00
17 TOPSOIL & SEEDING	1100	SY	$1.00	$1,100.00
18 HAUL OFF UNSUITABLE MATERIAL	150	CY	$3.00	$450.00

SUB. TOTAL		$52,657.00
MOBILIZ./BONDS/INSUR.	5%	$2,632.85
EROS. & SED. CONTROL	2%	$1,053.14
TRAFFIC CONTROL	2%	$1,053.14
PROFFESSIONAL SERVICES	15%	$7,898.55
CONTINGENCY	10%	$5,265.70
GRAND TOTAL		$70,560.38

LANGLEY & McDONALD, P.C.
5544 GREENWICH ROAD
VIRGINIA BEACH, VA. 23462

8 9 1993

PRELIMINARY COST ESTIMATING WORKSHEET

TOWN OF WEST POINT, VIRGINIA
MATTAPONI AVE.
JOB NO. 92093

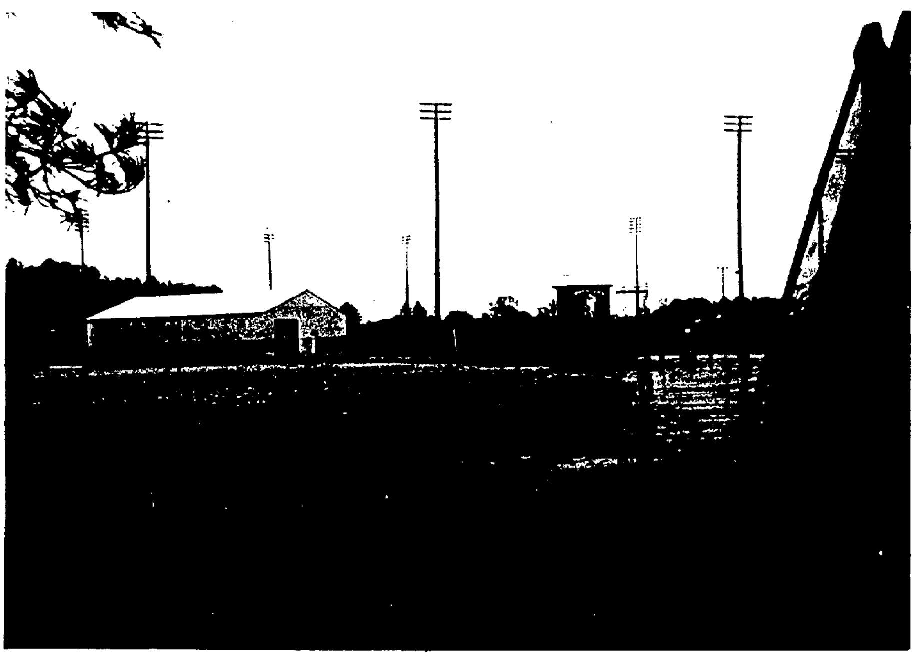
UPGRADE EXISTING STM. SYSTEM TO CARRY ULTIMATE 10 YR. STM
ADD CURB & GUTTER ALONG MATTAPONI AVE. & THOMPSON AVE.

LINE	ITEM	QUANT	UN	UNIT PRICE	ESTIMATED COST
1	12" RCP	768	LF	$14.00	$10,752.00
2	15" RCP	792	LF	$15.50	$12,276.00
3	18" RCP	260	LF	$18.00	$4,680.00
4	14"x23" ELL RCP	138	LF	$23.00	$3,174.00
5	19"x30" ELL RCP	340	LF	$31.00	$10,540.00
6	24"x38" ELL RCP	294	LF	$45.00	$13,230.00
7	29"x45" ELL RCP	330	LF	$56.00	$18,480.00
8	36" RCP	225	LF	$44.00	$9,900.00
9	42" RCP	728	LF	$50.00	$36,400.00
10	48" RCP	704	LF	$65.00	$45,760.00
11	54" RCP	810	LF	$80.00	$64,800.00
12	ES-1 15"	10	EA	$275.00	$2,750.00
13	ES-1 18"	3	EA	$310.00	$930.00
14	ES-1 54"	1	EA	$1,200.00	$1,200.00
15	PIPE REMOVAL @ DRIVEWAYS	504	LF	$4.50	$2,268.00
16	CATCH BASIN	29	EA	$2,400.00	$69,600.00
17	DROP INLET	5	EA	$1,000.00	$5,000.00
18	DRIVEWAY REPAIR	32	EA	$235.00	$7,520.00
19	MISC GRADING @ CULVERT & PONDING AREAS	1	LS	$2,000.00	$2,000.00
20	CURB & GUTTER	6250	LF	$7.50	$46,875.00
21	ASPHALT PAVEMENT REMOVAL	8950	SY	$3.00	$26,850.00
22	ASPHALT PAVEMENT REPLACEMENT	8950	SY	$12.00	$107,400.00
23	RELOCATION OF EXIST. UTILITIES	1	LS	$15,000.00	$15,000.00
24	SELECT MATERIAL	1000	CY	$8.00	$8,000.00
25	SELECT BEDDING	125	TN	$21.00	$2,625.00
26	RIP RAP	20	SY	$30.00	$600.00
27	WIDEN & REGRADE EXIST. DITCH	4500	LF	$4.00	$18,000.00
28	SIDEWALK REMOVAL	350	LF	$3.00	$1,050.00
29	SIDEWALK	925	SY	$16.50	$15,262.50
30	TOPSOIL & SEEDING	3500	SY	$1.00	$3,500.00
31	HAUL OFF UNSUITABLE MATERIAL	1200	CY	$3.00	$3,600.00
32	DITCH	800	LF	$7.50	$6,000.00

SUB. TOTAL		$576,022.50
MOBILIZ./BONDS/INSUR.	5%	$28,801.13
EROS. & SED. CONTROL	2%	$11,520.45
TRAFFIC CONTROL	2%	$11,520.45
PROFFESSIONAL SERVICES	15%	$86,403.38
CONTINGENCY	10%	$57,602.25
GRAND TOTAL		$771,870.15

APPENDIX 5
PHOTOGRAPHS

WEST POINT HIGH SCHOOL AUGUST 5, 1993



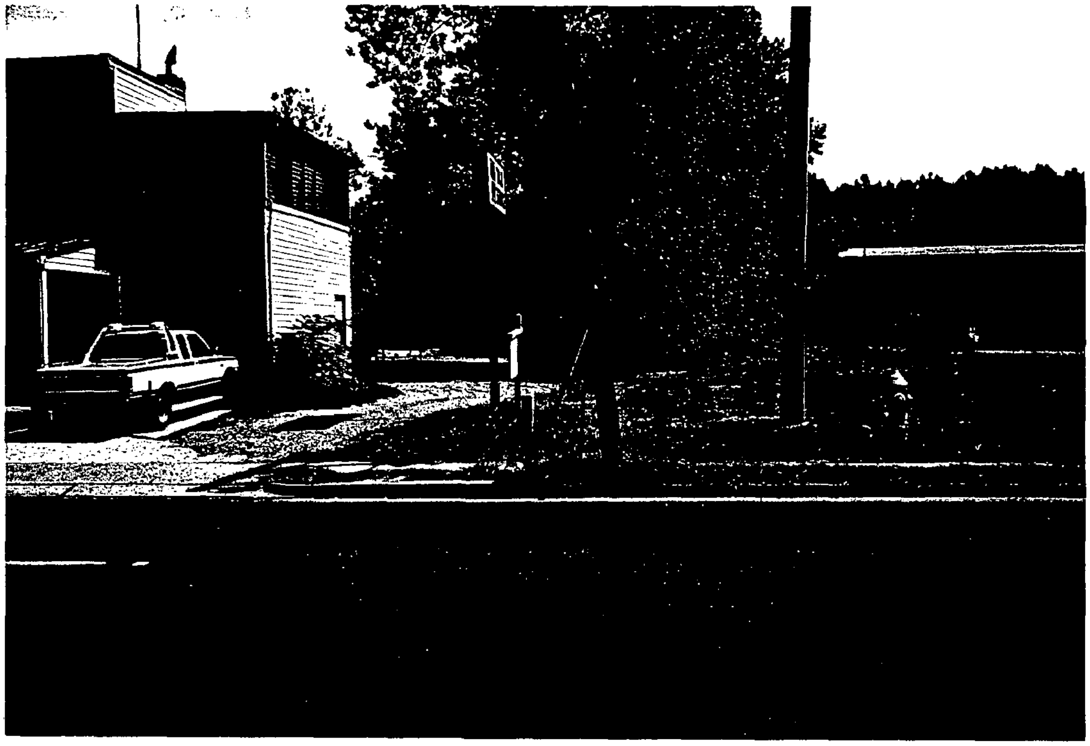
WEST POINT HIGH SCHOOL MARCH 4, 1993

WEST POINT ELEMENTARY SCHOOL
THOMPSON AVENUE

AUGUST 5, 1993

WEST POINT ELEMENTARY SCHOOL
THOMPSON AVENUE

MARCH 4, 1993



KING WILLIAM AVENUE
BETWEEN PAMUNKEY AVE. & MAGNOLIA AVENUE

AUGUST 5, 1993

KING WILLIAM AVENUE
BETWEEN PAMUNKEY & MAGNOLIA AVENUE

MARCH 4, 1993

MAINTENANCE ISSUES

DITCH NORTH OF 16TH STREET AUGUST 5, 1993

DROP INLET AT CORNER OF
KING WILLIAM AVE. & PAMUNKEY AVE. AUGUST 5, 1993

KING WILLIAM AVENUE
WELL-MAINTAINED CHANNEL

AUGUST 5, 1993

PRIVATE PROPERTY
FLOW IN CHANNEL IS BLOCKED

JUNE 14, 1993